



OFFICE MEMORANDUM

DATE: February 3, 1999

TO: Region Engineers
Region Associate Delivery Engineers
Region Construction Engineers
TSC Managers
Resident/Project Engineers
Region Traveling Mix Inspectors (TMI)

FROM: C. Thomas Maki
Chief Operations Officer

Gary D. Taylor
Chief Engineer/Deputy Director
Bureau of Highway Technical Services

SUBJECT: Bureau of Highway Instructional Memorandum 1999-1
Revisions to MDOT Materials Quality Assurance Manual

Since the complete revision and publication of the referenced manual in 1997, several sections have been revised. A brief description of the major revisions is presented below and the full text of the revised sections is attached. These revisions will be sent to all holders of the 1997 Materials Quality Assurance Manual through the MDOT Publications Office. In the future, all revisions will be issued to all holders of the Construction and Technology (C&T) Division procedures manuals as they are approved and implemented under the Bureau of Highway (BOH) Informational Memorandum process as stated in C&T's Division Guidance Document DL401.

Section A11 Construction Project Documentation Required for Minimum Job Control Deviations

This section was approved by BOH IM 1998-8 dated September 8, 1998, and will be included in this update distribution.

Section C1 General Materials Certification Procedures

This section has been revised to state that ASTM, AASHTO, or MDOT specifications for markings must be followed to allow material to be identified at the project site. Documentation requirements have been modified to reduce the amount of paperwork while still providing the appropriate level of quality assurance for certified material.

Section C2 Certification Verification Sampling and Testing

Corrugated metal pipe, steel end sections, and temporary concrete barrier were removed from the certification verification schedule as the certification verification requirements for these materials is covered in detail in other sections of the manual.

Certification verification requirements for several other materials were revised to more

accurately reflect the responsibilities of the C&T Division and Region materials staff.

Section C6 Prequalified Aggregate Supplier Program

This program, implemented in May 1998, was developed with substantial input from the Regions, the Federal Highway Administration, and the aggregate industry to replace the approved aggregate certifier program.

Section D10 Structural Steel Fabrication

A diagram was added to show the standard radiographic identification layout which is discussed in the text of paragraph 7.2 of this section.

Section F Qualified Products Lists

Thirteen product qualification procedures have been added or updated.

Section G3 Procedures Editors

This appendix is being deleted from the QA manual to eliminate duplicate information.

Chief Operations Officer

Chief Engineer/Deputy Director

BOHTS:C&T:RZ:dg:jp

Attachments

Subject Index: Materials QA Manual

cc:	Lansing C&T Division Engineers	R. Knapp	AUC
	Lansing C&T Division Technicians	J. Ruszkowski	CRAM
	Real Estate, M. Frierson	J. Reincke	MRBA
	Design Division	K. Trentham	MCPA
	OEO, A. Suber	J. Culp	MCA
	T. Maki	S. Cook	MAA
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CONSTRUCTION PROJECT DOCUMENTATION REQUIRED
FOR MINIMUM JOB CONTROL DEVIATIONS

1. Scope

1.1 This Procedure covers the deviation from minimum job control requirements on MDOT administered construction projects. Appropriate documentation shall be created and retained in the specific construction project's records whenever a decision is made to intentionally deviate from any minimum job control requirements of any of MDOT's procedures, publications or specifications.

2. Related Documents

- 2.1 1996 Michigan Standard Specifications for Construction
- 2.2 Materials Sampling Guide
- 2.3 Density Control Handbook
- 2.4 Construction Manual

3. Procedure

3.1 *MDOT Projects*

3.1.1 Whenever a MDOT Resident or Project Engineer decides to deviate from any minimum job control requirement, identified in any of MDOT's procedures, publications or specifications, appropriate documentation shall be created.

3.1.2 The Engineer shall create and date the documentation immediately upon the decision to deviate from the minimum job control requirement.

3.2 *Local Government Projects*

3.2.1 Whenever a Local Project Engineer decides to deviate from any minimum job control requirement, identified in any of MDOT's procedures, publications or specifications, appropriate documentation shall be created.

3.2.2 The project engineer shall create and date the documentation immediately upon the decision to deviate from the minimum job control requirement and shall obtain concurrence from the appropriate MDOT Engineer prior to filing the document.

4. Records

4.1 The document shall indicate the specific reasons that the decision is made.

4.2 Appropriate reasons may include applied statistical analysis, specific engineering principals, or other appropriate logic.

4.3 The document shall indicate the date of the recommendation, the name and date that the appropriate individual concurs with the recommendation, the job reference information, and any other extenuating information.

4.4 The documentation used for this operation shall be retained in the specific construction project's records.



OFFICE MEMORANDUM

DATE: January 15, 1998

TO: PROJECT FILE
CS54321-JN12345

FROM: Xxxxx Y. Zzzzzzz P.E.
Resident/Project Engineer

SUBJECT: Job Control Requirement Deviation

SAMPLE MEMO

The minimum requirements for in place density of aggregate base for this project currently are; 1 test per 150 meters per width of 7.5 meters or less.

The minimum requirement is revised, for this project only, to: 1 density test per 215 meters per width of 7.5 meters only if the current method of placement, conditions, and materials all remain the same. If a single failing test is recorded more frequent tests will be performed and the minimum will be revised back to the normal policy.

REASON: This project involves 4 kilometers of placement of Aggregate Base. The material being supplied is 22 AA (100% limestone) from the same certified source and has not materially changed. The method of placement and handling is established and is producing passing tests. All tests recorded in the last 1 kilometer section have passed. The material and methods are expected to remain the same and passing tests are also expected.

Signature - Project/Resident Engineer P.E.

cc: Region Materials Supervisor
Resident Engineer (for local agency projects only)

GENERAL MATERIALS CERTIFICATION PROCEDURES

1. Scope

1.1 MDOT allows some highway materials to be accepted by the Project Engineer on the basis of the supplier's written certification that all applicable specifications are met. There are different types of certifications required depending on the type of material, the impact of the material on the safety and integrity of the project and the experience of MDOT and other agencies with the material.

1.2 Certifiable materials are designated in the MDOT Materials Sampling Guide under "Basis of Acceptance" for each material.

1.3 Sections 1-7 of these General Procedures apply to all manufacturers and distributors of certifiable materials. Sections 8-10 cover procedures which apply only to manufacturers and distributors who have been given the privilege of certifying *specific* materials which would otherwise be tested on a job-by-job basis. These manufacturers and distributors have established a record of providing specification materials and are continually evaluated.

1.4 Where necessary, additional detailed procedures have been written to cover certification of individual materials. These detailed procedures follow the General Material Certification Procedures in this manual.

2. General

2.1 The MDOT Construction and Technology Division, is responsible for overseeing the Materials Certification Program, including issuing and withdrawing certification privileges based on Division and Region recommendations.

2.2 It is the contractor's responsibility to ensure that all certifications for material to be incorporated into the project are accurate and are delivered as required by Section 3.3 of this document.

2.3 When used in these procedures, ***manufacturer*** refers to a producer or fabricator of highway materials with control over the quality, workmanship and handling of material shipped to an MDOT project.

2.4 When used in these procedures, ***distributor*** refers to a supplier or broker of highway materials who has no control, other than through careful handling, over the quality and workmanship of material shipped to an MDOT project.

2.5 When used in these procedures, ***Approved Certifier*** refers to a manufacturer who has submitted quality control documentation and/or material samples for evaluation and who has been given status in accordance with Section 8 to certify *specific* materials.

2.6 When used in these procedures, ***Approved Recertifier*** refers to a distributor who has been given status in accordance with Section 9 to recertify *specific* materials which are manufactured by Approved Certifiers.

3. Certification Documentation

3.1 Where more than one piece of paper is included in the certification document, all pages must be numbered (_ of _) and include project numbers in order to reunite them should they become separated.

3.2 Upon delivery to a supplier or a project, all certified material, either bundled or palletted, shall be stenciled, stamped or otherwise identified as per ASTM, AASHTO, or MDOT specification to allow the material to be recognized and checked against the certification or recertification document. Certified material should not be incorporated into the work and will not be paid for until satisfactory documentation has been received by the Project Engineer.

3.3 Two complete copies of all certification documents must be furnished to MDOT. Each must contain the appropriate information specified in Section 3 in addition to the following:

- 3.3.1 Project number (Control Section/Job Number).
- 3.3.2 Date of shipment.
- 3.3.3 Name of contractor.
- 3.3.4 Name of material (MDOT designation).
- 3.3.5 Identification markings on shipment as required by Section 3.2
- 3.3.6 Quantity of material represented by the certification.

3.4 Certifications must be distributed as follows:

3.4.1 Two copies must accompany the shipment; (one for Project Engineer's files and one for contractors files) or be delivered to the Project Engineer's office.

3.4.2 One copy must be sent on date of shipment, to:

Mailing address; Michigan Department of Transportation
Construction and Technology Division
P. O. Box 30049
Lansing, Michigan 48909

or faxed to the Construction and Technology Division at (517) 322-5664 on the date of shipment.

4. Types of Certification

4.1 In addition to the requirements to Section 3

4.2 **Type "A"** certification consist of all of the following:

4.2.1 Laboratory test report(s) for samples obtained from the lot(s) of material represented by the certification and tested according to applicable specifications.

4.2.2 A list of all applicable specifications (ASTM, AASHTO, MDOT or other designations as appropriate) which the material is certified to meet.

4.2.3 Any applicable specification modifier such as class, grade, type, etc.

4.2.4 A notarized statement, signed by a responsible representative of the manufacturer or distributor, that the material represented by the certification meets all listed specification requirements.

4.3 **Type "B"** has been deleted.

4.4 **Type "C"** has been deleted.

4.5 **Type "D"** certification consists of all of the following.:

4.5.1 A list of all applicable specifications (ASTM, AASHTO, MDOT or other designations as appropriate) which the material is certified to meet.

4.5.2 Any applicable specification modifier such as class, grade, type, etc.

4.5.3 A notarized statement, signed by a responsible representative of the manufacturer or distributor, that

the material represented by the certification meets all listed specification requirements.

4.5.4 If material is certified by a distributor or an Approved Recertifier, the manufacturer's name must be included on the certification.

4.6 **Type "E"** certification is prepared by a fabricator to cover a composite item incorporating two or more materials which have been previously approved on an individual basis for MDOT projects, but which lose their identity when they are incorporated into the composite item.

4.6.1 All materials used in the fabrication of the item must be listed and identified.

4.6.2 The notarized certification statement must state that all materials used in the fabrication of the item were previously approved for state use.

4.6.3 The fabricator is required to supply test results and/or other pertinent identifying records for the individual materials incorporated into the composite item unless otherwise directed.

4.6.4 Composite items requiring a Type"E" certification include signs, overhead sign structures, etc.

5. Certification Verification Sampling and Testing

5.1 Material accepted on the basis of certification may be sampled and tested on a random basis by MDOT representatives for the purpose of verifying the quality of the certified material.

5.2 Certification verification sampling is discussed in more detail in Section C-2 of this manual.

6. Acceptance/Rejection of Certified Materials

6.1 Certified material will be accepted by the Project Engineer only when all applicable documentation requirements are met, and if visual inspection at the project site shows the workmanship and condition of the material to be satisfactory.

6.2 If any laboratory reports submitted as part of a Type"A" certification or resulting from the testing of certification verification samples indicate that a critical parameter falls outside specification limits by a significant amount, the Construction and Technology Division may recommend that the certified material be rejected. Prior to rejection of the material an investigation of circumstances will be made. This may include consultation with MDOT Design, Traffic and Safety, or Maintenance Divisions and the Project Engineer.

7. Withdrawal and Reinstatement of Certification Privileges

7.1 Failure to comply with any applicable certification procedures is justification for withdrawal of certification privileges. A warning letter may be written to the certifier, pointing out the failure and requesting action to rectify the problem.

7.2 Certification privileges may be withdrawn if the certified material deviates from specification requirements by a substantial amount in a critical aspect or if the material repeatedly fails to conform to specification requirements by any amount in any aspect.

7.3 Withdrawn certification privileges can be reinstated only if the certifier has corrected the identified deficiencies and has described the actions taken to prevent future shipment of nonconforming material. In the case of an Approved Certifier, testing of samples or review of other data may be required.

7.4 Additional requirements covering the withdrawal and reinstatement of certification privileges may be included in the detailed procedures for individual materials.

8. Approved Certifier/ Recertifier Status

8.1 Sections 8, 9 and 10 apply to manufacturers or distributors of materials which can only be certified by an Approved Certifier. These materials, which are otherwise tested on a job specific basis, are designated by an asterisk (*) under "Basis of Acceptance" in Section A of the Materials Sampling Guide. Lists of materials which are allowed to be certified only by Approved Certifiers and manufacturers who have been given this status are included in Section D of the Materials Sampling Guide. Distributors who have been approved to recertify materials manufactured by Approved Certifiers are also listed in Section C.

8.2 Approved Certifiers and Approved Recertifiers shall maintain quality control records and material certificates for a period of two years after the date of shipment for all material supplied on the basis of certification to MDOT projects. These records must be made available to MDOT representatives upon request.

8.3 Approved Certifiers and Approved Recertifiers must agree, in writing, to comply with all general certification requirements in addition to applicable procedures covering individual materials.

9. Application for Approved Certifier Status

9.1 The manufacturer of the material to be certified must contact the Construction and Technology Division, in writing to request consideration for Approved Certifier status. Requests must include the following information:

- 9.1.1 Specific name of the material to be certified (MDOT designation).
- 9.1.2 Specific AASHTO, ASTM, MDOT Standard Specification or other specification covering the material.
- 9.1.3 Manufacturer's Quality Control Procedure for the material. This can be a narrative description or a formal procedures manual.
- 9.1.4 Quality control test reports for the material covering a minimum of twenty (20) production runs. Acceptance test reports for materials used on MDOT projects or independent laboratory test results are acceptable.
- 9.1.5 Names of other state DOTs using the material.
- 9.1.6 Sample of the material if requested.
- 9.1.7 Sample certification form to be used when supplying material.
- 9.1.8 Shop drawing if required (ie., concrete hand holes).

9.2 The evaluation which follows will include a review of MDOT's experience with the material and the manufacturer to determine if it is appropriate to allow certification of the material: a review of the quality control program and test reports to verify that the manufacturer is capable of producing uniform material which consistently meets established specifications and contacting other agencies to determine their experience with the material and the manufacturer.

9.3 If the review indicates an adequate quality level, MDOT will permit certification on a provisional basis. During the time of provisional certification, the frequency of certification verification sampling by MDOT will be increased. Assuming that these samples continue to meet MDOT specifications, certification will be allowed on a continuing basis.

10. Approved Recertifier Status

10.1 Once a manufacturer has been given Approved Certifier status for a material, a distributor may request approval to supply that material based on recertification. This request must be made, in writing, to the Construction and Technology Division..

10.2 The following modifications to the requirements of Section 3 are applicable when an Approved Certifier supplies material through an Approved Recertifier:

10.2.1 The certification from the Approved Certifier to the Approved Recertifier is not required to show a project number.

10.2.2 When any portion of this material is shipped without modification to a project, the Approved Recertifier must issue a distributor's certification which states that the material represented is the same material covered by the Approved Certifier's certification.

10.3 If the Approved Recertifier has had additional processing performed on the material subsequent to receiving it from the Approved Certifier, the material is no longer covered by the Approved Certifier's certification. The processed material must be independently approved for certification by MDOT on the basis of testing and/or inspection.

CERTIFICATION VERIFICATION SAMPLING AND TESTING

1. Scope

1.1 Certification Verification will consist of periodic sampling and testing or field inspection of materials accepted on the basis of certification and shall be for the purpose of validating the quality of the manufacturer's product.

1.2 When the certification verification sample fails critical areas of the specification, the information can be used as the basis for either rejecting the material or delaying its use until additional samples can be tested.

1.3 Materials listed in the Materials Sampling Guide as certifiable, but not listed in these procedures, may be sampled and tested as special circumstances warrant.

1.4 The frequency for Certification Verification may be adjusted at any time by the Michigan Department of Transportation (MDOT) as deemed necessary.

2. General Responsibilities

2.1 The Construction and Technology Division will notify the appropriate Region Field Engineer of the need to perform Certification Verification sampling and/or field inspection for the items listed in schedule #1.

2.1.1 If the sampling and/or inspection cannot be performed within five (5) days of the receipt of these requests, the Construction and Technology Division shall be notified by telephone.

2.2 Materials not listed in schedule #1, but which also require regular Certification Verification sampling and/or inspection are listed in schedule #2.

2.2.1 It will be the responsibility of the Region Field Engineer to see that the Certification Verification required in schedule #2 is performed.

3. Submitting Samples

3.1 When submitting samples to the laboratory for testing, the words "Certification Verification" shall be entered on the Sample ID (Form 1923) in the area normally reserved for the project number.

3.2 If available, a copy of the certification representing the material sampled shall be attached to the Sample Identification.

3.3 Project numbers may be entered under remarks on the Sample Identification.

4. Field Inspection Reports

4.1 All field inspection reports submitted to the Construction and Technology Division shall note "Certification Verification" in the area normally reserved for project number.

4.2 Project numbers may be shown under "Remarks".

4.3 A statement indicating whether the material does or does not meet specification requirements will be entered under "Remarks".

4.4 If available, a copy of the certification representing the material inspected shall accompany these field inspection reports.

4.5 Project Engineers will not receive copies of Certification Verification Field Inspection Reports except when failures occur in critical areas, per paragraph 1.2.

5. Laboratory Reports

5.1 Test reports issued by the Testing Laboratory will be reported as "Certification Verification" rather than for specific projects.

5.2 Project numbers, if shown on the Sample Identification, will be entered under "Remarks".

5.3 Project Engineers will not receive copies of "Certification Verification" test reports except when failures occur in critical areas, per paragraph 1.2.

6. Sampling Schedules

6.1 The District Support Section will issue the appropriate instructions to the District Field Engineer for sampling and/or inspection for those items in schedule No. 1 (Schedule 1 table on next page).

SCHEDULE NO. 1

Spec Number	Material Name	First Sample	Subsequent Samples	Unit
905.03	Uncoated Steel Reinforcement	9,000	226,800	kg
905.03C*	Epoxy Coated Steel Reinforcement	9,000	226,800	kg
905.06	Welded Steel Wire Fabric Reinforcement	6,300	27,900	m ²
907.03D	Steel Posts For Woven Wire Fence	1,000	10,000	ea
908.12	Steel Beam Guardrail Elements	1000	8,000	PCS
908.13*	Steel Post For Guardrail	1000	5,000	ea
909.05A*	Corrugated Metal Pipe (Metal Sheets)	150	1,500	m
909.07B	Corrugated Plastic Tubing for Underdrains	1,500	15,300	m
910.05A	Prefabricated Drainage System	3,000	30,500	m
912.09	Post and Blocks for Beam Guardrail	1,000	10,000	ea
913.03B	Concrete Brick	10,000	300,000	PCS
913.05	Concrete Block for Drainage Structures	10,000	300,000	PCS
914.03	Fiber Joint Filler for Concrete Construction	100	2,000	m ²
914.08	Dowel Bars, Uncoated	3,000	30,000	ea
914.08A	Dowel Bars, Coated	3,000	30,000	ea
914.12	Bituminized Cotton and Fiberglass Fabric	10	100	rolls
916.02	Silt Fence	1,000	3,000	m
917.10	Seed Mixtures	6,800	10,000	kg
919.03D	Steel Posts For Delineators	1,000	10,000	ea
919.04A	Steel Posts For Signs	3,000	30,500	m
919.05	Sawed Wood Posts for Highway Signs	250	2,500	ea

*See Special Instructions next page for these items.

- 905.03C Epoxy Coated Steel Reinforcement
Wrap samples to protect the coating from possible damage during shipment. Both the bar manufacturer and the coater's name shall be shown on the Sample Identification, form 1923.
- 908.13 Steel Post For Guardrail
Field inspection to determine average weight per meter, dimensions and weight of Spelter coating. Submit one post to laboratory. Report test results on Report of Field Inspection, Form 566.
- 909.05A Corrugated Metal Pipe (Metal Sheets)
Samples will be obtained from fabricated pipe or from stock at the fabricator's yard per instructions of the Construction and Technology Division. The Sample Identification (form 1923) shall include the sheet manufacturers name and the pipe fabricator's name.

6.2 The Region Field Engineer is responsible for the control of the Certification Verification sampling and/or testing on the following items in accordance with the references noted for each:

SCHEDULE NO. 2

- 901.03 PORTLAND CEMENT - See Materials Sampling Guide.
- 901.07 FLY ASH - One (1) for each five (5) CV samples of Portland cement per plant. The fly ash sample shall be accompanied by a sample of the Portland cement with which it is being used.
- 902.01 AGGREGATES - See Section C-3 of this manual.
- 902.12 MINERAL FILLER FOR BITUMINOUS MIXTURES - See Procedures Manual for Bituminous Plant Inspection.
- 904.01A ASPHALT BINDER - See Procedures Manual for Bituminous Plant Inspection
- 905.07 STRAND FOR PRESTRESSED CONCRETE - One (1) per project.
- 909.04 CONCRETE PIPE PRODUCTS; RCP & NRCP AND RELATED ITEMS - See Section C-5 of this manual.
- 909.SP STRUCTURAL PLATES FOR PIPE - One (1) per project. Submit sample at least 5625 square millimeters (75 mm X 75 mm) in size to the M&T Division Laboratory.
- 910.03 GEOTEXTILES - See Materials Sampling Guide, Per Special Provision only Recommended guidelines for normal sampling frequency, additional samples may be taken as directed by the Engineer.
- 918.01D ELECTRICAL CONDUIT (NON-METALLIC) - One (1) sample per manufacturer, a minimum of two (2) samples per construction season.

PREQUALIFIED AGGREGATE SUPPLIER PROGRAM

1. Scope

1.1 The Michigan Prequalified Aggregate Supplier Program allows eligible aggregate Suppliers the opportunity to provide material to Michigan Department of Transportation or federally funded projects by assuming responsibility for quality control testing. Prequalified aggregate suppliers approved by Michigan Department of Transportation's (MDOT's) Construction and Technology Division with concurrence from the controlling MDOT Region will maintain compliance with the following procedures and other special instructions which may be issued to assure adequate quality control.

2. Definitions

Supplier-An aggregate producer or distribution point having ownership of the material.

Controlling Region-The Michigan Department of Transportation (MDOT) Region in which the aggregate source or distribution point is located.

Using Region-The MDOT Region where the project is located.

C & T-Michigan Department of Transportation's Construction and Technology Division Aggregate Quality Control Group.

Warning Band- The upper and lower gradation limits before corrective action is started. This value is established by the supplier to maintain a uniform product.

3. Prerequisite Requirements

3.1 *Testing area*-The area used for aggregate testing must meet Michigan Occupational Safety and Health Standards. It shall be large enough with ample work surfaces to conduct the prescribed tests. These tests require adequate lighting, good ventilation, a water supply, and a heated work area for use in cold weather. MDOT does not require the testing area to be located in a permanent structure.

3.2 *Equipment*-Scales must meet ASTM C-136 accuracy requirements for all sample sizes and be calibrated annually. The necessary wire cloth sieves meeting ASTM E-11 criteria shall be kept in the laboratory and in good condition. Aggregate drying equipment must meet the requirements listed in Michigan Test Methods (MTMs) 108 and 109. Mechanical splitters shall conform to ASTM C-702. All other equipment which is used in aggregate sampling and testing will be in good working order.

3.2.1 Failure to maintain equipment meeting proper standards may result in the loss of prequalified status.

3.3 *Personnel*-The supplier will employ or have under contract a Michigan Certified Aggregate Technician (MCAT). If the sampling and testing are not performed by an MCAT, then an MCAT shall witness the sampling and testing being conducted.

3.3.1 Failure to maintain current MCAT certification can result in the loss of prequalified status.

4. Aggregate Supplier Prequalification Requirements

4.1 The aggregate supplier will submit a written request to C & T asking for admission into the Prequalified Supplier Program. C & T will forward a copy of the letter to the controlling Region office. The letter shall include the following items:

- Source name(s)
- Aggregate Source Inventory(ASI)number(s)
- Contact person
- An alternate contact person
- Work telephone number(s) for each person
- Location or type of testing facility
- The specific Michigan aggregate series (MDOT designation) produced or supplied at each source which is to be prequalified.

4.1.1 When a supplier wants to add another source or aggregate series to this program, the supplier shall notify the controlling Region in writing. A copy of the request will be forwarded to C & T. The source will be added if current laboratory facilities are used for quality control. A joint inspection by C & T and controlling MDOT Region will be required before approval if the laboratory facilities have not been previously inspected. All other requirements in this program must be met for the new source.

4.1.2 Should ownership of a prequalified source change, the new owner shall notify C & T in writing. A copy of the letter will be forwarded to the controlling Region. C & T will coordinated with the controlling Region to schedule an inspection and review of the quality control plan. All prerequisite requirements must be met.

4.2 Sampling and testing procedures followed by the supplier shall be in accordance with Michigan Test Methods, ASTM and AASHTO standards as referenced in Standard Specifications for Construction, MDOT Materials Sampling Guide, Procedures for Aggregate Inspection, Materials Quality Assurance Procedures Manual, appropriate supplemental specifications and/or special provisions.

4.3 *Documentation*-All test results will be kept for a minimum of three calendar years. An approximation of each week's production for each prequalified aggregate will be documented. This information shall be available upon request to MDOT.

4.4 *Quality Control Plan*-The supplier shall establish and maintain a process control program which has been reviewed and approved by MDOT's Construction and Technology Division and controlling MDOT Region. This program will aid the supplier in producing uniform materials.

4.4.1 A quality control plan will include at least the following information unless a wavier is granted for a specific item:

4.4.1.1 Production Sampling Frequency and Location

- What plant checks are routinely performed
- Where and when samples are obtained
- Approximate amount of material covered by each test.

4.4.1.2 Major events including plant start up, screen changes, and breakdowns which affect aggregate production must be documented.

4.4.1.3 Analysis of Test Results to produce a control chart which will be posted in a prominent location and kept up to date.

- The update interval will be stated

4.4.1.4 Action Plan for suppliers who produce their own aggregates when material is outside warning band or specification limits:

- List what operational procedures will be followed to bring the material back within specification.
- State when and where sampling and testing the new production will occur.
- The supplier will halt or divert the new production from adding to the existing stockpile if the test results indicate the material is still outside specification limits.
- *In addition, the disposition of any material failing to meet specifications will be recorded.*
- *What method is going to be used to distinguish the failing material from the specification material.*

4.4.1.5 All other suppliers when the supplier is a dock, concrete plant or transfer point and a failing test result occurs:

- The failing aggregate will be removed from the stockpile until specification material is located.
- The supplier will increase their testing frequency for the aggregate remaining in the stockpile.
- *The disposition of all failing material will be recorded.*
- *What method is going to be used to distinguish the failing material from the specification material.*

4.4.1.6 The load-out sampling and testing frequency will be specified.

4.4.2 A copy of the Quality Control Plan will be sent to the Construction and Technology Division Aggregate Quality Control Group and the controlling MDOT Region for review. An acknowledgment will be sent by C & T to the supplier upon completion of review.

4.4.3 Quality Control Plan changes must be reviewed by both C & T and the controlling Region. An acknowledgment will be sent by C & T to the supplier after the review is finished.

5. Supplier Notification of Shipment

5.1 The supplier shall notify the controlling MDOT Region's Materials Supervisor by facsimile the same day as the first aggregate shipment for each calendar year.

5.2 Each aggregate shipment delivered to a project or concrete plant shall be accompanied by a delivery ticket containing the MDOT aggregate source number, date of shipment, control section number, job number, or concrete plant number (if applicable), Michigan series number and class letter of aggregate, weight or volume shipped, supplier's name, telephone number and location. In addition, the following statement shall be printed or stamped on each trip ticket. "I attest that aggregate as delivered from this prequalified source meets specification requirements for listed Michigan series and class for quantity stated. Date_____ Signature_____." This statement must be signed by an authorized company representative.

5.2.1 Lack of delivery tickets or proper documentation can be cause for rejection of the aggregate.

5.3 The supplier will generate a summary report each week whether or not any material is shipped and FAX it to both the controlling Region's Materials Supervisor and Lansing's Construction and Technology Division Aggregate Quality Control Group by the close of business on Monday of the week following shipment. The weekly summary report shall have the date it is generated, be sequentially numbered and include the following information for each type of aggregate; quantity and date shipped, the destination including MDOT project number, concrete plant number (if applicable), or Purchase Order Number.

5.3.1 When the supplier does not anticipate any aggregate shipments to MDOT or federal aid projects for several weeks, they may write "Until further notice, no state work" on the last weekly summary. Once this report is transmitted, the supplier will not be required to continue sending the weekly summaries. *Notification by FAX to the controlling MDOT Region's Materials Supervisor must be made on the same day shipments resume to federally funded or MDOT projects during the construction season.*

5.3.2 At the close of the construction season, the supplier may write "Last shipment for the season" on the weekly summary report.

5.3.3 Failure of the supplier to provide the controlling MDOT Region and C & T with weekly shipping summaries may result in suspension of prequalified status as stated in Section 9. In addition, improper use of the options in paragraphs 5.3.1 and 5.3.2 could also lead to a suspension of prequalified status.

5.3.4 C & T shall notify the supplier and affected MDOT Regions by certified mail of suspension of prequalified status.

5.3.5 Withdrawn prequalified privileges may be reinstated by consensus agreement between Construction and Technology Division Aggregate Quality Control Group and the controlling MDOT Region after the supplier has corrected their problems to the satisfaction of MDOT in accordance with Section 10.

6. MDOT Monitoring and Quality Assurance Program

6.1 Each Region's Materials Supervisor will have on file a copy of each supplier's weekly summary and a copy of each aggregate test run by region personnel on materials used within their region on MDOT projects.

6.2 MDOT's C&T Division will coordinate with the controlling MDOT Region in conducting a laboratory inspection of prequalified aggregate suppliers' equipment, procedures, and personnel prior to admission to the program and every two years thereafter. If significant production changes are made or if problems are indicated by other aspects of the monitoring program, more frequent inspections may occur. This inspection shall cover but is not limited to the following; the testing area, equipment, and quality control plan. In addition, MDOT will evaluate the supplier's sampling and testing procedures.

6.2.1 If a consulting firm is used by the supplier for quality control testing, C & T in conjunction with the controlling MDOT Region must conduct an inspection of the consulting firm's laboratory prior to admission to the program and every two years thereafter.

6.2.2 If a Prequalified Supplier switches consulting firms, their prequalified status will be suspended until a new inspection and approval of the testing facilities can be obtained. Should the new consulting firm be already participating in this program, the inspection may be waived.

6.2.3 A formal report will be prepared by Lansing's C & T Division following each biennial inspection. A copy will be sent to the supplier and to the controlling MDOT Region. Deficiencies will be listed and requirements for corrective action given, including a time frame. Follow-up monitoring or testing may be done to assure that deficiencies are rectified. Failure by the supplier to correct deficiencies may result in loss of prequalified status.

6.3 The controlling Region will conduct Independent Assurance Tests on the supplier's quality control technician(s) according to the frequency given in the Independent Assurance Sampling and Testing chapter of the Materials Quality Assurance Procedures Manual..

6.3.1 If test results exceed Independent Assurance comparison limits, an investigation will immediately be made to determine the cause of the differences and what corrective action needs to be taken.

7. MDOT Quality Assurance Testing

7.1 MDOT's Region materials personnel will obtain random quality assurance (reduced acceptance) samples on each prequalified aggregate series. The aggregate may be randomly tested at any time prior to use. However, the sampling should be conducted as close as possible to the point where the material is incorporated into a mixture or the project. The minimum testing frequency will be one test per 10,000 metric tons of material shipped.

7.1.1 When more than 5000 metric tons of a single aggregate type is being shipped per week, the minimum testing frequency may be further reduced to one test per 30,000 metric tons provided the supplier has a two-year history of quality assurance (reduced acceptance) tests exceeding 90% compliance with specifications.

7.1.2 The project quality assurance samples will be checked against the appropriate specification requirements and not to the supplier's load out test results.

7.2 The controlling MDOT Region will retain a copy of all quality assurance test records for a minimum of three (3) years.

7.2.1 A copy or computer record of the quality assurance test results will be forwarded to C & T.

8. Failing Material Resolution

8.1 If a quality assurance sample taken from the source or point of use does not meet Standard Specifications, the controlling MDOT Region will immediately notify the supplier by telephone and inform the supplier of the resample time and location. In addition, the supplier's quality control tests will be reviewed.

8.1.1 Aggregate Resample at source: If the original sample was taken from the stockpile's shipping face at the aggregate's source, which includes docks or yards, two resamples will be obtained from the same stockpile's shipping face using the mini-stockpile sampling method. If the average of the original and two resamples meet specifications, then the material is approved for use and no further action is necessary. If the average of the first test and two resamples do not meet specifications, then the failing material will be removed from the stockpile until specification material is located within the stockpile. Continued production of borderline material will result in three(3) months' probation. Should the supplier refuse to remove the failing material, their prequalified status will be revoked and the project engineer, contractor, and Lansing C & T informed immediately.

8.1.2 Aggregate Resample at Point of Use: If the original sample was procured at a point of use, two resamples will also be from either the same location or another point of use provided the aggregate is from the same source. If the average of the original sample and two retests meet specifications, the material will be approved for use and no other action is required. However, more frequent sampling may be prudent. If the average of the original sample and the two retests fail to meet specifications, the technician will immediately inform the project engineer, contractor, supplier, and Lansing C & T. All shipments from the source will stop until the supplier can sample their aggregate and are certain their material meets specifications. The supplier will not be allowed to ship the disputed material until the controlling Region's materials personnel have confirmed the supplier's test results. Continuing to provide non-specification aggregate will result in three (3) months' probation.

9. Removal From Program

9.1 Probation: This condition means a supplier has been classified as noncompliant with this program by MDOT. Any of the following list of infractions can result in a supplier being placed on probation:

- Delivering non-specification material to MDOT or federal aid projects.
- Failure to maintain a MCAT technician.

- Failure to maintain equipment meeting the requirements stated in this document.
- Failure to maintain proper documentation.
- Failure to follow approved quality control plan.
- Failure to notify the controlling District when aggregate shipment starts.
- Failure to send MDOT the weekly shipment summaries.
- If the percentage of MDOT test results meeting specification requirements drops below 90%.

9.1.1 While on probation, the supplier will send copies of their quality control test results to the controlling region and Lansing C & T. The controlling region will increase their testing frequency. Probation is the first step toward a supplier losing their prequalified status.

9.2 Repeat infractions will result in loss of prequalified status.

9.3 The occurrence of any other type of infraction while on probation may result in the loss of prequalified Supplier status.

9.4 The following infractions can result in the immediate loss of prequalified status:

- Being uncooperative with MDOT in removing failing aggregate from a stockpile.
- Refusing to supply MDOT with copies of quality control records when requested.
- Falsification of any documents or test results.
- Shipping from a non-prequalified source.
- The percentage of MDOT Quality Assurance test results meeting specification requirements drops below 80%.

10. Restoration to Prequalified Status

10.1 The following steps must be taken for a supplier who has had their prequalified status removed:

- Reapply in accordance with this program.
- Update all application documentation.
- Specifically address the reason for losing the prequalification privilege and propose appropriate remediation of the original problem.

The controlling Region Materials Supervisor in conjunction with C & T will review the new application. Reinstatement to the program will place the supplier on a probationary status. The supplier will be re-evaluated after twelve months to see if their standing can be upgraded.

STRUCTURAL STEEL FABRICATION

1. Scope

1.1 *Qualifications and Responsibilities of Inspection Agency* - The agency responsible for the fabrication inspection of structural steel should have a registered professional engineer on its staff who is qualified to practice in the discipline of welding engineering. This engineer is responsible for the review and approval of the shop drawings detailing the methods of fabrication and welding, conducting the welding procedure and welder qualification tests and/or professional decision making on fabrication and welding problems that arise. He/she is responsible for holding a fabrication meeting with the structural steel fabricator to discuss and clarify the contract plans and specifications. The welding engineer is the responsible party, representing the owner, who ensures all the provisions of the contract are met in relation to welding, fabrication, painting and materials requirements.

1.2 The agency must also provide on-site fabrication inspection by personnel qualified and certified as welding inspectors under the AWS Standard for Qualification and Certification of Welding Inspectors, QC-1. This inspector's duties are described in the next section. The agency must also provide on-site inspection of the shop painting of structural steel by personnel who are qualified in the application and inspection of high technology paint systems such as are specified on MDOT contracts. (This painting inspector may be same person as the welding inspector providing he/she has been adequately trained in addition to the welding inspection requirements.)

2. General

2.1 *Duties of the Welding Inspector* - Before he/she is assigned to a project, an inspector should have a thorough knowledge of bridge welding and of his/her duties as an inspector. He/she should be supplied with a complete set of design and shop drawings, proposal and specifications for that contract and a complete set of inspection tools and gages.

2.2 Before actual welding operations on a contract are started, a pre-fabrication meeting should be held with the inspection agency's welding engineer and inspector and the fabricator to ensure they know which procedures and sequences of welding are to be allowed, which welders are qualified, which electrodes and materials have been approved for the contract and how these materials should be stored, and what welding equipment is acceptable for use on the contract. There should also be agreement on the methods of nondestructive testing to be used and the welds to be inspected by these methods. All details of the fabrication should be discussed, agreed upon, and recorded in written minutes of the meeting.

2.3 Inspection of welding is similar to inspection of any other work performed during bridge construction. It consists of ensuring the plans and specifications are followed. Before welding is started in a shop or at a field location, the inspector should observe that the steel is not bent or damaged and has no visible external defects exceeding the tolerances prescribed in ASTM A 6. He/she should ensure that it is prepared and assembled with proper fitting for sound welds and for maintenance of correct dimensions and alignment. He/she should also ascertain that suitable provisions are made so the shrinkage during welding can be accommodated without causing distortion or shrinkage cracks. He/she must be certain shop jigs and fixtures, erection falsework, and other supporting devices are arranged so the welder is not unduly restricted in his/her movements and is able to see the point where he/she is welding and is able to weld in the proper position.

2.4 After welding has started, the inspector observes the welding procedures, techniques, and sequences to ensure the welds meet the requirements of the plans and specifications. The various steps of the welding procedure, especially for multiple pass butt welds, must be performed carefully to ensure the surfaces are clean where the weld metal is to be deposited, the weld is being made in accordance with the approved procedures and distortion is not becoming serious. All objectionable distortions should be recorded and called to the fabricator's attention even if they do not appear serious enough to require correction. If the fabricator does not correct these distortions, the engineer should be notified before the work advances so far that the correction is difficult.

2.5 The inspector should refer to the engineer all decisions he/she is not authorized to make, he/she is not capable of making because of his/her lack of experience and knowledge of engineering and welding theory, or that he/she thinks would affect the function of any part of the structure in an important way. He/she should convey the engineer's interpretations of the plans to the fabricator.

2.6 A welding inspector should have enough welding experience to be able to differentiate satisfactory and poor welding techniques on sight and to recognize and identify satisfactory welding procedures by description. He/she should also have enough knowledge of the nondestructive testing (NDT) methods, techniques, and procedures to inspect bridge welds and to know when to call for and how to use the results of such nondestructive tests to guide the repair of discovered defects.

3. Referenced Documents

- 3.1 Michigan Standard Specifications for Construction
Section 707. "Structural Steel Construction"
Section 906. "Structural Steel", Materials Details
- 3.2 Contract Supplemental Specifications and Special Provisions
Section 707. "Special Provision for Structural Steel and Aluminum Construction"
- 3.3 American Welding Society Bridge Welding Code, AWS D1.5-XX

4. Procedures

4.1 Prior to welding, the following checklist is suggested as a general guide in making welding inspections in the shop or in the field. The actual steps and their exact sequence will depend upon the type of structure, the method of erection and the qualifications of the welders who are to do the work. The checklist pertains particularly to welding and related operations and does not include all of the items that should be checked.

4.1.1 At the fabricating plant, check the mill test reports on the base metal for conformance with the specifications with regard to mechanical properties and chemical properties to the extent that they are specified. Develop a workable system for identifying the heat number of each piece of steel that is used in contract fabrication and recording its location in the structure. Obtain from the fabricator, if necessary, the shipping records, storage locations, and scheduling for each piece of steel that he/she intends to use in connection with the assigned contract. Examine each piece of steel as it is received at the shop or construction site to see that it has no uncorrected defects, kinks, or bends resulting from improper handling while in the mill or shop or in transit from mill to shop or shop to construction site.

4.1.2 Check the records or other evidence of welders' qualifications and investigate the continuity of their work since the date of qualification tests. Have requalification or supplementary check tests made of a welder's ability, if needed. MDOT Specifications require that all tackers, welders and welding operators be qualified prior to welding, either by direct testing or by a previous welding test that is acceptable to the engineer. In a new fabricating shop, previous records are not accepted and a complete testing program is normally carried out.

4.1.3 Ensure that the welding procedures and sequences are agreed to and understood by the inspector, the contractor, the foreman and the welders performing the work. Make certain the contractor has proper instructions regarding the number and type of procedure qualification tests required and such tests are satisfactorily performed and recorded. Michigan Specifications require *all welding procedures* be qualified by test prior to any job welding. This qualification requirement is inclusive of all types of weld procedures, i.e. butt welding, fillet welding, seal welding, plug welding, etc. No welding procedures are considered to be prequalified, regardless of what the AWS Specifications allow or what previous procedure tests produced by the fabricator may indicate. See the Supplemental Specifications in the contract for testing requirements on the procedure test welds. Post the welding procedure data, such as amperage, voltage and travel speed at each welding machine.

4.1.4 Make a general examination of the structural steel and give particular attention to the quality of fabrication, including accuracy of plate edge preparation, which would affect control over welding. Require any necessary correction to be made before fitting of welded joints is done. Check the appearance and dimensions of shop welds and make certain no welding has been done previously at unspecified locations. Record and call to the fabricator's

attention any unspecified welding. Also notify the engineer so that he/she may specify corrective measures.

4.1.5 Check the fitting of joints that are to be welded, including dimensions of root face, angle of bevel, cleanliness, match marks, alignment of parts to be joined, and uniformity and size of root openings. Recheck root faces and angles of bevel because trimming and rebeveling of plate edges is sometimes done during fitting. Check the prepared edges of the weld joints for evidence of possible undesirable internal defects such as laminations in the steel plate. Make dimensional checks of all critical measurements to assure a proper fit in the field.

4.1.6 Check the fixture, clamping, and precambering arrangements used in the fabrication assembly setup for adequacy. Make certain tack welds are made by qualified welders and the welds are small, smooth, and of specified quality. See that runoff or extension bars or plates are in place to ensure complete welding beyond the edges of the plates.

4.2 Welding in Progress

4.2.1 During inclement weather, see that suitable windbreaks or shields are provided and welding is not done on surfaces that are wet or exposed to rain or snow. Check temperature of steel at start of and during welding to determine if the specified preheat and interpose temperature requirements are being observed. Use temperature-indicating crayons or other equivalent means to check these temperatures.

4.2.2 Check to make certain the correct types and sizes of electrodes are available and they are dried properly to prevent porosity and cracking in the final welds, especially if low-hydrogen electrodes are specified. If electrodes and fluxes have been stored improperly or exposed to humidity in excess of the tolerances permitted, require reconditioning as prescribed by the specifications.

4.2.3 At suitable intervals, observe the technique and performance of each welder to be certain the approved welding procedures and suitable techniques are being used to conform to the requirements of the applicable specifications. At important joints, especially if some unusual condition warrants special attention, inspect multiple pass welds at more than one stage of progress. Arrange for the welder or the foreman to notify the inspector when such inspections at various stages may be made.

4.2.4 Require all welding be done by the approved procedures and sequences and make certain electrodes are used with suitable currents and polarity and in positions for which the electrodes are intended to be used. Refer to the approved welding procedure specification for all details of performing the weld in question. Report any unusual or excessive distortion during welding and take corrective measures agreed to by the engineer and the fabricator to hold distortion and locked-in stresses to a minimum.

4.2.5 Require that the welding arc be struck only in the groove or other area on which metal is to be deposited and not at random on the base metal outside of the prepared joint. Arc strikes cause physical and metallurgical stress risers that can and often do result in fatigue failures. Do not permit any welding of ground bars, clips and ties. Approval for such welding is given only by the engineer and only when unavoidable. When steel ground bars are used instead of ground clamps to carry the welding current to the base metal, make certain the ground bars are carefully welded to the base metal at a runoff tab or securely clamped to any area where all mill scale has been removed. Keep the grounding lead as close to the point of welding as is practical.

4.2.6 Inspect root passes with special care because it is very important the first weld materials deposited in the root of a multiple pass weld be done properly. Closely examine the root pass in important groove welds, such as butt welds in flanges and webs, to make certain it has been made properly and is free from cracks, inclusions or lack-of-fusion.

4.2.7 Require the root pass and every subsequent weld pass to be cleaned by the use of a wire brush and chipping hammer to thoroughly remove slag between weld passes to avoid inclusions, before the next weld pass is made. Have defects and substandard workmanship in any weld pass removed by chipping or gouging before subsequent passes of metal are deposited. Do not permit peening or consolidating of weld metal by hammering without the special approval of the engineer. Do not permit peening on root passes or final surface passes of a weld under any circumstances. Under conditions of very severe restraint, minimize weld cracking by other more acceptable techniques, such as using a cascade buildup sequence. Avoid any interruptions in the welding of a critical joint other than those necessary to change electrodes and quickly clean the slag from a layer before the next one is deposited.

4.2.8 Take particular care not to create re-entrants or local areas with high residual stresses in highly stressed parts of principal members. Where beam flanges do not match well at butt welded splices, require that the weld metal be deposited in such a way as to provide a smooth transition between the parts being joined. Be certain that temporary fitting aids, such as plates and angles, are not applied at highly stressed locations and that temporary tack

welds are not allowed.

4.2.9 Check all members to make certain the welds are of proper size and length, are being made in the proper location to conform to drawings and are performed in such a manner as to produce weld metal conforming to the requirements of the specifications. To determine whether the weld metal is being deposited in such a manner as to penetrate well into the root of a joint without producing excessive slag inclusions or porosity, a field test may be conducted by making a T-joint with a fillet weld on only one side of the stem of the T. This joint can be broken open easily for visual examination. If welds are to be ground smooth and flush for any reason, have grinding done so grinding marks are not left transverse to the direction of the main stress in a member. Check to make certain welds are not being overground so as to produce a "dished" surface. Require the ends of welds be ground smooth on removal of the runoff tabs.

4.2.10 Identify with paint each splice of an important member with the symbol of the welder doing the work, but do not steel stamp this identification on the member. If two welders work on such a splice, show the symbol of each and record, in writing, the work each man performed.

4.2.11 Record progress of fabrication on Status of Work forms. Include dates work was completed and pertinent remarks regarding problems encountered and corrective action taken.

4.3 *After Welding*

4.3.1 Require welds to be cleaned of slag and weld spatter so they can be given a thorough final examination. Be certain the surfaces of the welds are reasonably smooth and of suitable contour without evidence of undercut, overlap, excessive convexity, insufficient throat or leg size, unfilled craters at the ends of welds, or other defects in excess of the limits prescribed by the specifications. Refer to the specifications for the appearance of welds containing these various kinds of defects. Ensure all scars and defects, such as undercutting or remnant portions of tack welds and other scars that are left after the removal of temporary fitting and erection clips, are corrected to be within the tolerances specified for the quality of the steel.

4.3.2 Ensure the required radiographic, ultrasonic, magnetic particle, or dye penetrant tests are performed as specified. Check to see the weld surfaces and adjacent plate surfaces are in satisfactory condition for the NDT process to be used.

4.3.3 If the specifications require certain qualifications for NDT equipment or for operators, check records or obtain evidence of acceptable qualifications. If there are no specific requirements, refer the matter to the engineer so he/she may specify what tests are necessary to ensure the adequacy of the testing equipment.

4.3.4 Check the performance of NDT operators at frequent intervals to verify approved procedures are being used, all weld joints to be tested are examined in accordance with specified requirements and results are properly recorded and identified. The testing of critical flange and web butt splices by the contractor should be witnessed by the inspector.

4.3.5 Ensure rejected welds are properly identified and marked for repair and defect locations are clearly marked. Observe the excavation defects, use magnetic particle tests to verify no part of the defect remains. Require repaired welds be inspected by the specified NDT method.

4.3.6 Check visually after blast-cleaning for weld surface defects and general pickup such as grinding welds, where required, grinding edges, and cleaning holes. Make a final visual inspection check prior to painting.

4.3.7 Check the storage, loading, blocking, and handling of the welded members to avoid distortion or structural damage. Do not permit welding of braces or lugs to the members.

4.3.8 Check and report on the appropriate forms the final camber and required curvature (or sweep) of all girders after all fabrication steps have been completed. Any members that measure out of tolerance must be noted for corrective action and rechecked after the correction has been made.

4.4 *Inspection for Cleaning and Coating Fabricated Steel* - The painting inspector is responsible for the enforcement of all the contract specifications and requirements for the cleaning and coating of the structural steel. All Michigan Department of Transportation steel bridge contracts specify high technology coating systems. Most steel bridges are totally shop coated (i.e., primer and final top coats) by the fabricator. Advanced training in the application and evaluation of these systems is mandatory for successful inspection. At present MDOT is the only agency that provides this paint inspection training. This is offered periodically as time and personnel are available. The essential phases of painting inspection are summarized as follows.

4.4.1 *Check the Environmental Conditions* - The contract special provisions for painting will include specific controls on environmental conditions, e.g. temperature, humidity, cleanliness, air movement, shading, etc. These specified conditions must be strictly enforced.

4.4.2 *Inspection of Coating Materials* - All paints used must be carefully mixed, thinned and handled in accordance with the specifications. Record all batch numbers used to be compared to the certification documents. Check the color numbers of the top coat for conformance to the contract specifications.

4.4.3 *Inspection of Cleaning and Coating Equipment* - High technology coating systems employ the most sophisticated blast cleaning and spray painting equipment developed. A thorough knowledge of their operation and use is required by the inspector. The inspector is responsible for evaluating the performance of the equipment prior to the coating of the structural steel. If any of the equipment is operating outside of the specification limits the coatings will not be properly applied and may fail (peel off) at some time after application.

4.4.4 *Inspection of Steel Surface Conditions* - All grinding, welding repairs, and fabrication steps must be completed before blast cleaning and painting. Any remedial work done after coating may be grounds for rejection of the coating system. The steel must be free of all traces of grease and oil before blast cleaning is done.

4.4.5 *Inspection of the Surface Preparation* - The contract specifications require an exact surface cleanliness standard and a surface "peak" profile requirement. These must be measured using specialized equipment and strictly enforced. After approval, the temperature of the steel and the surrounding air must be maintained within the specified limits. Humidity requirements must also be strictly observed.

4.4.6 *Inspection of Coating Application* - The inspector needs to be knowledgeable in the proper techniques of applying the high technology coating systems. Improper application techniques may "appear" to give an acceptable result but will lead to a greatly reduced performance life and possibly an early coating failure (blistering and peeling). After each of the coatings are applied it is the responsibility of the inspector to ensure the *temperature and humidity* are properly controlled (see contract specifications) over the required curing time. After each coating has cured the inspector must check the dry film thickness for conformance to the contract requirements before *the next coat is applied*. General appearance of the coating must be approved by the inspector, noting any objectionable runs, sags, rough texture or dry spray. Corrective actions must be taken on each coat of the painting system before the next coat is applied. Ensure that approved written coating repair procedures are followed.

4.4.7 *Documentation* - A log of the coating sequence may prove to be very valuable if a problem develops. It is suggested that the inspector maintain this log if at all possible. Documentation of an approved coating on the structural steel is comprised of the inspector's test reports on the coating evaluations and the submission of a Certificate of Compliance by the paint manufacturer on the coatings used. MDOT coating systems are approved by yearly testing by MDOT which leads to inclusion on a Qualified Products List found in the contract special provisions. The Certificate of Compliance attests to the fact the painting materials supplied are the same as those submitted to MDOT for acceptance testing.

4.4.8 *Handling, Storage and Shipping* - The painting inspector must work closely with the welding inspector to ensure all the contract special provisions concerning the handling, storage and shipping of shop painted steel are strictly observed. The steel is stamped "Approved For Use" by the welding inspector only after the structure is loaded for shipping and properly padded and secured to prevent damage in transit. All damage to the paint done during handling and loading by the fabricator must be repaired using the approved procedures prior to the inspector's final stamp of approval. If this is not possible because of inclement weather conditions, the fabricator must submit to the inspector a written documentation of the damaged areas so they can be distinguished from the coating damage done during the unloading and erection of the structure.

4.5 *Interpretation of Drawings and Specifications* - Although plans and specifications have been checked and usually are complete by the time a project has reached the construction stage, there is always a possibility of omissions or dimensional errors. Therefore, they should be checked to assure sufficient and correct information is given to complete the work properly. In case of conflict between the approved shop drawings and the contract plans and specifications, the contract documents shall govern.

4.5.1 The plans and specifications cannot always predict and cover clearly some conditions such as injury to steel in handling and transportation, the effect of unusual weather conditions, and the effect of method of assembly or erection. The inspector should evaluate the effect of any such unusual conditions on the quality of the welding and reach an agreement with the contractor with regard to any necessary corrections or changes that should be made. All remedial or repair work must have the approval of the engineer prior to performing the work and must be documented in writing in the contract files.

4.5.2 For various reasons, plans for a structure must sometimes be changed after construction work has started. In addition, the removal of materials or parts of a structure and their replacement may alter welding conditions. In such cases, the inspector should analyze the conditions carefully to make certain, if they affect the suitability of the welding procedures or sequences, proper revisions are approved by the engineer in advance of the start of the welding on that portion of the structure. It is essential that he/she refer such matters to the engineer for advice and guidance.

4.5.3 The workmanship clauses of welding specifications usually include information that can be used in interpreting drawings and in determining suitable dimensional tolerances for weld grooves and for the finished work. When inaccuracies in preparation of plate edges and in fitting at welded joints result in weld-groove dimensions which vary from those shown on the approved detail drawings by more than the specified workmanship tolerances, the matter must be referred to the engineer for approval or correction.

4.6 *Nondestructive Testing* - By contract, nondestructive testing of steel fabrication is the responsibility of the fabricator's Quality Control personnel. The inspector represents the owner in a Quality Assurance role to certify the nondestructive testing requirements of the contract have been properly performed and documented. The methods of nondestructive testing applicable to welded structures are radiographic, ultrasonic, magnetic particle, and liquid dye penetrant. Knowledge of the principles and procedures of these methods is essential to ensure the operators are satisfactorily performing and test results are correctly interpreted.

4.6.1 *Procedures* - Radiographic testing of weldments must be in accordance with all the requirements of the contract plans and specifications. A written radiographic procedure must be submitted to the engineer for approval prior to any contract work. This written procedure must include a drawing which clearly shows the positioning of penetrometers, film and identification markers (see Section 7, Suggested Radiographic Testing Procedures).

4.6.1.1 The detailed ultrasonic testing procedure for welds in structures is usually prescribed by the applicable specifications. A typical procedure is included in the AWS Welding Code. The procedure involves the calibration of the equipment so sensitivity is at a specified level and sound travel is suitable for the thickness of the welded plate to be inspected. The calibration is required before testing starts and at frequent intervals during testing. A written procedure specification for ultrasonic testing must be submitted for the engineer's approval prior to any contract work. The inspector is responsible for submitting to the engineer the proper documents that establish the ultrasonic operator is qualified in accordance with the contract specifications.

4.6.1.2 Magnetic particle and liquid dye penetrant testing must be performed as indicated by contract plans and specifications. Each inspection test should follow standard recommended practices and methods as designated: "Magnetic Particle Examination", ASTM E 709 and "Liquid Penetrant Inspection Method", ASTM E 165. The inspector is responsible for witnessing and reviewing these inspection tests, as well as determining the test performer is qualified. Test results should be documented in the project file and mentioned on the weekly inspection report.

4.6.2 *Interpretation* - The interpretation of all nondestructive testing is primarily the requirement of the fabricator's Quality Control personnel. The inspector is responsible to the owner for reviewing all the fabricator's interpretations and calling any disagreements to the attention of the engineer. The engineer's interpretation is final and he/she may also call for additional testing to further explore a discrepancy.

5. Weekly Inspection Report and Project Close-out

The inspector shall complete an accurate and detailed account of fabrication for each project. The weekly "Shop Inspection Report" will be sent to the engineer for approval and distribution. The report shall include a

discussion of fabrication progress for all aspects of the work. It is intended to be a detailed record of the status of fabrication and should include number of pieces or units fabricated, documentation of specification and procedure compliance as well as documentation of conflicts, repairs, and other problems or discussions which could affect the project in any way. Inspector's report shall include steel mill certifications, letter of compliance and final shippers statements all supplied by the fabricator.

6. Inspector's Equipment

To perform the necessary Quality Assurance Inspection duties on a Michigan bridge fabrication, the inspector must have the following equipment for evaluating the work:

- Welding Inspection

- Contract plans and proposal
- All pertinent contract specifications
- Fillet weld gages
- Measuring devices - tapes, calipers, etc.
- Straight edge and levels
- Undercut gages
- Surface roughness comparator gage
- Instrumentation for measuring voltage and amperage
- Temperature measuring devices capable of covering the range from 4 °C to 900 °C
- Required safety equipment - hard hat, shoes, glasses, welding hood, flashlight, etc.
- Packet of forms for job documentation
- Office supplies
- Approval stamps, tags and paint
- Office space, desk and phone supplied by the fabricator as a contract requirement

- Painting Inspection

- Testex Replica Tape kit for measuring blasted steel surface profile
- S.S.P.C. Book of Pictorial Blast Standards
- Temperature and humidity measuring instruments
- Wet film paint thickness gage
- Dry film paint thickness gages - Positector type (with calibrated standards) and Tooke gage

7. Suggested Radiographic Testing Procedures

7.1 The radiographic inspection of weldments as required by the contract shall be performed in accordance with the applicable AWS Welding Code as modified by the contract special provisions. The following procedure is a suggested format that meets the requirements of most MDOT bridge contracts.

7.1.1 The contractor shall furnish a satisfactory viewer and darkroom facility for developing and viewing the radiographic film. The contractor shall also provide shop space and time for all radiographic work. All safety precautions as required shall be followed and enforced by the contractor.

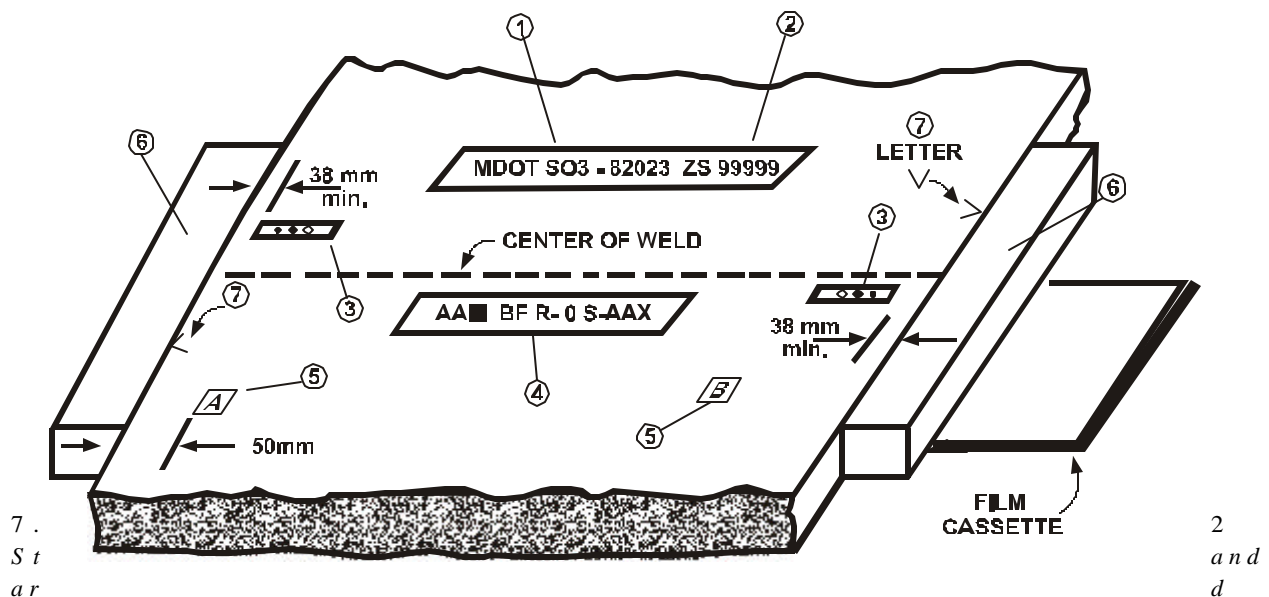
7.1.2 Radiographic inspection shall be conducted on 100% of all tension flange butt welds and compression flange butt welds. All web splices shall be radiographed for 305mm, but not less than 1/3 the length of the web weld beginning at the point of maximum tension, plus 305 mm of the web splice beginning at the compression end. (This includes splices connecting pin plates to webs.) All other areas to be radiographed shall be at the discretion of the engineer. All joints to be radiographed shall be free of dirt, scale, grease, etc. Flange splices shall be ground flush on both sides and webs ground flush at the area to be radiographed (one side). The direction of grinding shall be perpendicular to the length of the weld. All runoff tabs or other appendages shall be completely removed before radiographic inspection.

7.1.3 Radiographs shall be taken and interpreted by experienced and qualified technicians or radiographers as approved by the engineer. The radiographic film and a report of the technician's interpretation shall be submitted to the engineer for his/her final approval before the weld is accepted. The film type shall be of fine grain nature, Class I or Class II. Dimensions shall be 115 mm by 430 mm minimum. When areas to be radiographed are too large for one film, the additional exposures will become necessary. The limits for one film shall be 380 mm for web shots and 400 mm for flange

shots. Either x-rays or gamma rays may be used to produce radiographs. Double lead screens shall be used to back the film. Screens may be either pure lead or antimony lead with a maximum of six percent antimony. Tin coated lead foil or fluorescent screens shall not be used. If radiographic inspection discloses defective welds, the defective portions shall be removed and the material rewelded. Additional films shall be taken of all repaired welds at the expense of the contractor, and then submitted to the engineer for approval.

7.1.4 The interpretation of all radiographic films shall be furnished to the engineer by the contractor. The interpretation report shall be submitted on a form as approved by the engineer. Should the engineer question the interpretation of the radiographic film by the technician, or should the contractor question the interpretation of the engineer, a joint review shall be made. The engineer's final interpretation will govern.

7.1.5 All radiographs shall be positively identified by the contractor in accordance with AWS D1.5-XX and Section 6. Identification lettering of radiographs shall be placed on the source side along with the penetrometers. Lettering of repairs shall show an "R" and the number of the repair, and shall be placed next to the weld identification.



Radiographic Identification Layout - (numbers refer to diagram above.)

Explanation

- ① State project and structure number.
- ② Fabricator's initials and shop contract number.
- ③ Penetrometers. Use penetrometers for nominal thickness of each plate; but penetrometer for thicker plate not to exceed penetrometer for thinner plate by more than 10.
- ④ Weld Identification. Identification should identify the exact location of the weld in relation to piece number and location.
- ⑤ Location Letters. Placement of location letters is necessary to relate the location of questionable areas or defects should repair be necessary. More location letters must be added in the event more than one shot is required.
- ⑥ Tight fitting steel edge blocks shall have a thickness equal to or greater than the thickness of the weld on all weld ends.
- ⑦ Lead vees shall be placed at edge to delineate the top edge on the radiograph. Additional identification may be used as required. All lead numbers and penetrometers must be placed on the source side of the plate being radiographed.

7.2.1 The use of "blocks" as illustrated is required. The use of these edge blocks will give a better picture of the edges, both top and bottom; and are especially useful when the limits of the film are being crowded. (i.e., one shot

on a 400 mm flange.)

8. Inspection Forms for Job Documentation

8.1 The use and disposition of various job control forms for structural steel fabrication inspection is described below. Forms similar to the ones shown may be substituted but the main topics requiring documentation should remain as shown. The forms are described below and examples are in the appendix.

8.2 *Shop Inspection of Structural Steel, Form 538* - This form is completed by the in-shop inspector on a weekly basis on each separate bridge structure and should be a brief narrative of the work done over the reporting period. Any problems encountered in the work should be mentioned. The distribution of the report needs to be mainly to the welding engineer representing the owner, the project engineer and the Materials and Technology Division job file. (Other distributions may be made as required.) The inspector retains a copy for his own job file for each separate bridge structure.

8.3 *Status of Work - Shop Inspection of Structural Steel, Form 538C* - This form is used by the in-shop inspector to keep an accurate progress log on the status of each girder being fabricated on a bridge. The form should be kept up to date on each separate bridge under inspection. The form is kept in the *inspector's job file only* until the job is complete at which time a copy is submitted to the Materials and Technology Division job file. The form is very useful for allowing anyone to determine the exact status of each bridge girder and also for determining the approximate time various fabrication and painting steps were performed.

8.4 *Mill Certification Record for Fabricated Steel, Form 538D* - This form is completed by the in-shop inspector during the fabrication of a bridge. An entry is made for each girder in the bridge and the actual mill certification heat numbers for every plate used in constructing the girder are recorded in an orderly sequence (including beams, cover-plates, webs, flanges, splice plates). A notation is made when the corresponding mill certification has been received and checked by the inspector. This documentation is retained by the inspector until the job is complete and then is submitted to the Materials and Technology Division file attached to the mill certification test reports. When the mill certifications for a job have been completely received and checked by the inspector, who reports this on Form 538, *Shop Inspection of Structural Steel*, the form is then distributed to the project engineer and other interested parties. The mill certifications and letter of compliance are retained in the Materials and Technology Division files and are not sent to the project engineer.

8.5 *Site Notice, Form 523* - This form is used to document problems or to give official notice of a change or other items that may arise at the fabricating plant. The inspector may issue the Site Notice on behalf of the engineer. Notices should be numbered consecutively on each bridge structure and a copy distributed to the contractor (fabricator), project engineer and welding engineer. The contractor should sign the Site Notice to acknowledge receipt of it, but this is not mandatory nor does it signify his/her agreement with the notice given.

8.6 *Sample Identification, Form 1923* - This form should be submitted with every welder or welding procedure qualification test and every material or bolt sample taken for a job. Instructions for filling out the form are on the reverse side of the form. The inspector should keep a copy of all such submittals in his job folder.

8.7 *Welding Qualification Report, Form 1929* - This form is submitted with each test of a welder, welding operator or welding procedure. All the available particulars requested on the form must be completed since the approvals issued from these tests are conditional for the variables tested.

8.8 *Camber Measurements, Form 507* - This form is used by the in-shop inspector to record the actual measured camber (MC) on a beam or girder and to compare it to the design plan camber (PC). The inspector is responsible for checking the deviation in camber from the plan camber and calling for correction of any readings that are out of tolerance. New ordinates should be recorded after such corrections are made. The inspector retains this form in his/her shop file for submittal to the Materials and Technology Division file when the job is complete.

8.9 *Magnetic Particle Inspection Report, Form 538A* - This form is used by the in-shop inspector to record all magnetic particle testing done on the bridge beams, girders or components. Any defects noted must show an approved status after repairs and retesting are complete. The form is retained by the inspector and submitted to the Materials and Technology Division file when the job is complete.

8.10 *Field Inspection Report, Form 566* - This form is completed by either the inspector or the engineer when a field investigation or inspection is conducted on a new bridge structure. The completed report should be distributed to the project engineer, the district field engineer, the welding engineer, the Materials and Technology Division file and the in-shop inspector. Any follow-up work or inspection required should be clearly noted and the responsible parties notified. Subsequent reports on a problem should reference all previous reports issued.

9. Acceptance - Each beam end shall be stamped or tagged "Approved for Use" prior to shipment by the Shop Inspector.

**Qualification Procedure
For
Prepackaged Hydraulic Fast-Set Materials for
Patching Structural Concrete**

1. Scope

1.1 This document covers the physical requirements for prepackaged hydraulic mortars for use in structural concrete repairs and the procedure to be followed by producers in order to have their products included on MDOT's Qualified Products List.

2. Submittal Procedure

2.1 *Qualified Products Evaluation* - Submit a report as required by this procedure to the MDOT address listed below.

Materials Research Unit
Research Laboratory
8885 Ricks Rd.
P.O. Box 30049
Lansing, MI 48909

2.2 *Product Data Sheets* - Include product literature describing the product's use and the following information:

- 2.2.1 Substrate preparation
- 2.2.2 Bonding slurry requirements
- 2.2.3 Mixing and working times
- 2.2.4 Allowable temperature range for placement
- 2.2.5 Type of mixer recommended
- 2.2.6 Component ratios of mixed ingredients
- 2.2.7 Amount of coarse aggregate extension for deep patches
- 2.2.8 Type and duration of curing required
- 2.2.9 Use of admixtures not included in the product.

2.3 *Evaluation based on the following* - Submit a report of tests conducted by an independent laboratory. The physical properties of the product must meet the requirements given in Table 1 of this procedure. Descriptions of the test methods are included in this procedure.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product.

Person in charge of	
Qualified Products List	- Tom Hohm
Telephone	- (517) 322-1223
Person in charge of Testing	- Elias David
Telephone	- (517) 322-1222

2.5 *Evaluation Scheduling* - MDOT will be allowed 40 days to review and verify the submittal.

3. Evaluation

3.1 The submitted information and test data will be reviewed for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List. The submitter will be notified in writing concerning the result of the evaluation. MDOT reserves the right to verify submitted test results or reevaluate a product at any time by conducting its own tests.

3.2 MDOT must be notified in writing of any change in the product formulation. Formulation changes require reevaluation of the product.

4. Disqualification

4.1 A product may be removed from the Qualified Products List if any problem develops during mixing, casting, or with performance.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected.

6. Testing Procedure

6.1 The following testing must be conducted by an independent testing laboratory.

6.2 *Extension with Coarse Aggregate* - All specimens will be cast from a uniform mix design, extended with coarse aggregate at the maximum rate recommended by the producer. The extension rate at which the aggregate is tested for qualification will be included on the Qualified Product List as the maximum aggregate extension. The recommended mix design must produce a material that is basically self-consolidating and self-leveling.

6.3 *Number of Specimens* - The physical properties at each specimen age will be the average of a minimum of three specimens.

6.4 *Curing of Specimens* - All specimens will be cured as recommended by the producer during the initial 24 hours. Subsequent curing will be air curing at laboratory temperature and humidity. Specimens will be cured in this manner until testing.

6.5 *Compressive Strength* - The compressive strength of the material will be determined by using 51 mm cubes molded and tested according to ASTM C 109, or by using 102 mm by 203 mm cylinders according to ASTM C 39.

6.6 *Shear-Bond Strength* - The test specimens will be prepared by casting in a 25 mm thick cap on a 100x100 mm diamond blade sawed face of a 75 mm high concrete block. The bond face of the test block will be ground to a uniform texture with a no. 36 grit aluminum oxide grinding abrasive. The specimens will be tested in a single shear with the load applied to the 25 mm cap. The specimens used to test the bond performance after 50 freeze-thaw (F-T) cycles may be conditioned in either a freeze-thaw machine conforming to ASTM C-666, Procedure B, or subjected to a daily F-T cycle for 50 cycles. The specimens will be a minimum of 28 days old prior to the freeze-thaw conditioning.

6.7 *Slant Shear-Bond Strength* - Test material for bond strength according to ASTM C882 and as modified below.

6.7.1 Prepare 76 mm or 102 mm diameter dummy sections using 307 kg of cement per m³ of concrete. Saw cut cylinders at 30° to result in a dummy section meeting the dimensional requirements given in Figure 1 of ASTM C882. The 102 mm diameter dummy sections will be 4/3 times the dimensioning specified in Figure 1 of ASTM C882. Grind the bond face of the specimen to a uniform texture with a no. 36 grit aluminum oxide grinding abrasive.

6.7.2 Place the dummy section in the lightly oiled 76 mm by 152 mm mold for 76 mm dummy section and 102 mm by 203 mm mold for 102 mm dummy section. Position the dummy section with the slant side up. Place the prepared hydraulic mortar in the mold in three layers of approximately equal volume. Rod the bottom layer as thoroughly and deeply as possible. Strike off the top of the specimen. Cover, cure, and test according to ASTM C882.

6.8 *Modulus of Elasticity in Compression* - The modulus will be determined by using either 102 mm by 203 mm or 152 mm by 305 mm cylinders. Cast and test according to ASTM C469. The cylinders will

be loaded in compression and the strain read at a minimum of 5 equal intervals between 2.8 Mpa and 13.8 MPa. The reported modulus will be the average of the results at these intervals. The specimens will be at least 28 days old at the time of testing.

6.9 *Thermal Coefficient of Expansion* - The specimens and length of comparator will conform to ASTM C490. The specimens will be 51mm by 51 mm by 286 mm with an effective gage length of 254 mm. The coefficient will be determined from readings taken at -18 °C and 40 °C.

6.9.1 The specimens will be wrapped in an insulating material and conditioned for 96 hours at each temperature. If the measurements are taken at room temperature, they will be taken within 15 seconds of removal from the conditioning environment. If the specimen fails to return to its original length after the final measurement at laboratory temperature, the test will be repeated.

6.9.2 Use the following equation to determine the coefficient:

$$\frac{L_{40} - L_{-18}}{254 \times 58}$$

6.10 *Initial Plastic Shrinkage* - Use ASTM C1090 to determine the initial plastic shrinkage.

6.11 *Surface Scaling* - Make two slab specimens 150 mm diameter by 20-25 mm thick. Cure specimens for 28 days prior to initiation of testing. Install metallic tape dikes around the perimeter so that the dyke will pond water. The specimens will be conditioned in a freeze-thaw machine conforming to ASTM C-666, Procedure B, or subjected to daily freeze-thaw cycles. The daily cycle will consist of 16 to 18 hours in a freezing environment measuring -18 °C to -9 °C followed by 6 to 8 hours at laboratory temperature. The testing and ponding schedule of specimens undergoing either procedure will consist of:

6.11.1 Precondition specimens by ponding at room temperature for 24 hours with fresh water.

6.11.2 Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.

6.11.3 Subject specimens to 24 freeze-thaw cycles while ponded with a three percent solution of sodium chloride (NaCl).

6.11.4 Subject specimens to 12 freeze-thaw cycles while ponded with fresh water.

6.11.5 The depth of the ponding solution will be maintained at approximately 7 mm. Each time the ponding solution is changed, all loose scale will be carefully removed, oven dried and weighed. After the scale has been removed, the slabs will be rinsed with water prior to ponding with the fresh solution.

6.11.6 The accumulated total of scale volume per unit area for each slab will be determined as follows:

$$\text{Scale} = \frac{\text{Dry Weight of Scale, g}}{\text{Dry Bulk Specific Gravity} \times \text{Ponded Area, cm}^2} = \frac{\text{cm}^3}{\text{cm}^2}$$

6.12 *Working Time* - The working time will be the time measured from the addition of the mix water to the point when the material is no longer workable. Conduct the test at standard laboratory conditions using a minimum of 1.5 liter of material.

(SEE NEXT PAGE)

7. Physical Requirements

Table 1

	2 hour	4 hour	28 days	50 F-T cycles
Compressive Strength, ASTM C109 or C 39 min. MPa	13.8	17.2	31.0	---
Shear Bond Strength, min, MPa	1.4	1.6	1.6	1.4
Slant Shear Bond Strength, ASTM C-882 mod., min., Mpa	1.7	2.6	10.3	10.3
Modulus of Elasticity, Compression MPa			27,580-41,370	
Thermal Coefficient of Expansion mm/mm/°C			$9.0-14.4 \times 10^{-6}$	
Initial Plastic Shrinkage, max. (%)	0.10			
Surface Scaling, max (cm ³ /cm ²)				0.01
Working Time, min.	10 minutes			

**Qualification Procedure
For
Adhesive Anchor System**

1. Scope

1.1 This document covers the procedure to be followed by producers to have an Adhesive Anchor System included on the Michigan Department of Transportation's (MDOT) Qualified Products List.

2. Submittal Procedure

2.1 *Qualified Products Evaluation Form* - There is no form required for submittal, however, information about the product shall be submitted to the following MDOT address.

Structural Research Unit
Construction & Technology Division
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909

2.2 *Product Data Sheets* - Submit two copies of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc.

2.2.1 Include product literature describing the product's use and other pertinent information such as mixing, working times and component ratios of mixed ingredients. Also include anchor type, application, packaging, limitations, and installation.

2.2.2 Submit product safety data sheets.

2.3 *Evaluation based on the following standards* - The producer shall show the minimum embedment depth, for A307 bolt diameters 9.52 mm to 22.22 mm and Grade 420 MPa metric rebar diameters #13 to #25, required to develop the yield strength of the anchor. Test results, in accordance with ASTM E-488, are required from an independent laboratory for verification of the minimum embedment depth and shear strength.

2.3.1 Long term load (creep) tests should be performed in accordance with ASTM E-1512. The results shall be submitted prior to acceptance.

2.3.2 Resin Adhesive System Anchors, when subjected to tension, shall develop 125% the yield strength of the rebar or bolt at less than or equal to 1600 μ m displacement in 28 MPa concrete. The anchor shall develop the yield strength when subjected to shear. The tensile stress area of the bolt (nominal area for reinforcing steel) will be used when determining the yield load.

2.3.3 Submit a minimum of 300 cubic centimeters of epoxy and/or three capsules per anchor size 12.70 mm and 22.22 mm, a dispenser, four nozzles and any special equipment necessary for installation for evaluation by MDOT.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of		
Qualified Products List	-	Douglas Needham
Telephone	-	(517) 322-1979
Person in charge of		
Testing	-	Chris Davis
Telephone	-	(517) 322-1649

3. Evaluation

3.1 The submitted information and test data will be reviewed for conformance to the specified requirements. The product's susceptibility to corrosion, method of load transfer, installation procedure, workmanship, reliability and requirements specific to a particular design will also be evaluated. If the product meets the requirements, it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. Michigan Department of Transportation reserves the right to verify submitted test information or re-evaluate a product anytime by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

5. Requalification

5.1 A product that has been disqualified and removed from the Qualified Products List will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

**Qualification Procedure
For
Mechanical Expansion Anchors**

1. Scope

1.1 This document covers the procedure to be followed by producers in order to have a mechanical expansion anchor included on the Michigan Department of Transportation's (MDOT) Qualified Products List.

2. Submittal Procedure

2.1 *Qualified Products Evaluation Form* - There is no form required for submittal. However information about the product can be submitted to the following MDOT address.

Structural Research Unit
Construction & Technology Division
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909

2.2 *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc.

2.2.1 The producer shall include verified test results from an independent testing laboratory including static load tests for tension and shear, tested in accordance with ASTM E-488.

2.3 *Evaluation based on the following standards* - Submit three mechanical expansion anchors per size for evaluation by MDOT.

2.3.1 Mechanical expansion anchors shall meet the following proof tensile loads (125% yield strength x tensile stress area) and shear loads (yield strength x tensile stress area) when attached to a 28 MPa hardened concrete:

Ultimate Load		Bolt Diameter, mm									
		9.52 (3/8")*	10	12	12.70 (1/2")*	15.88 (5/8")*	16	19.05 (3/4")*	20	22.22 (7/8")*	24
Tension (Pull-out)	kN	15.7	18.1	26.3	28.6	45.6	49.1	67.3	76.6	93.1	110.3
Shear	kN	12.6	14.50	21.1	22.9	36.5	39.3	53.9	61.3	74.5	88.3

* Anchors manufactured to English Customary Units

2.3.2 Mechanical expansion anchors shall develop 50% of the proof tensile load at less than or equal to 1600 μ m displacement.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of	
Qualified Products List	- David A. Juntunen
Telephone	- (517) 322-5707
Person in charge of Testing	- Chris Davis
Telephone	- (517) 322-1649

2.5 *Evaluation Scheduling* - Completed Qualification Procedure packets, including evaluation forms and product submittal, must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the Qualified Products List will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The product's susceptibility to corrosion, method of load transfer, installation procedure, workmanship, reliability, and requirements specific to a particular design, will also be evaluated. If the product meets the requirements it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. Michigan Department of Transportation reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

**Qualification Procedure
For
Mechanical Reinforcement Splicing**

1. Scope

1.1 This document covers the procedure to be followed by producers in order to have a mechanical reinforcement splice approved for MDOT use.

2. Submittal Requirements

2.1 *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturer's trade name, model number, etc. of the sample submitted to the MDOT address listed below:

Structural Research Unit
Construction & Technology Division
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909

2.2 *Report of tests* - The producer shall include test results from an independent testing laboratory demonstrating that the mechanical reinforcement splice meets the following criteria:

- 2.2.1 All splices tested shall develop a tensile strength of 125% of the reinforcing bar's yield strength
- 2.2.2 All splices tested shall develop a fatigue strength of 83 MPa tension at greater than 1,000,000 cycles.
- 2.2.3 To be considered for special "high fatigue strength" usage, all splices tested shall develop a fatigue strength of 124 MPa tension at greater than 1,000,000 cycles.

2.3. *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product: Larry Pearson (telephone 517/322-5727) or David Juntunen (telephone 517/322-5707).

2.4 Sample Submittal.

2.4.1 The producer shall provide splices for verification testing by MDOT in order to verify independent test data. When special equipment is not required to prepare the splice, the producer shall provide the samples unassembled with installation instructions. If special equipment is required to prepare the splice, arrangements shall be made where a representative of MDOT can witness the assembly of the test samples. If this is not feasible, the producer shall prepare the test samples and supply information on the procedure used to prepare each splice. The following number of test samples shall be provided (Note: MDOT currently accepts soft-converted metric reinforcement sizes.):

Small Size: Submit 4 samples; minimum size equals #13 or smallest splice available if larger than minimums shown here. A combination of small size bars can be submitted.

Medium Size: Submit 4 samples; a combination of #9, #22, or #25 bars can be submitted.

Large Size: Submit 4 samples; maximum size equals #36 or largest splice available if smaller than the maximums shown. A combination of large bar sizes may be submitted.

Test sample bars shall have 300mm exposed length beyond the prepared splice. The bars shall be Grade 400 MPa and supplied by the producer.

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. The product will also be reviewed for general workmanship, corrosion protection, ease of installation, and any requirements specific to a given design. Please note: Only splices having collinear axes after splicing will be approved, i.e., offset bar splices will not be accepted. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or reevaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately disqualified from MDOT use should any problem develop related to installation or performance of the product. A product may also be removed due to specification changes made by either MDOT or the product manufacturer.

5. Requalification

5.1 A product which has been disqualified will be considered for reevaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.

**Qualification Procedure
For
Low Dust Abrasives**

1. Scope

1.1 This procedure describes the requirements for an abrasive to be placed on Michigan Department of Transportation's (MDOT) Pre-qualified Materials List for Requirements for Approval of Low Dust Abrasives.

2. Submittal Procedure

2.1 Submit the following criteria to the MDOT address listed below.

MDOT- Construction & Technology Division
Testing and Research Section - Paint Systems
Secondary Governmental Complex
8885 Ricks Road
Lansing, MI 48909

2.2 *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturers' trade name, model number, etc.

2.2.1 A 25 kg sample must be submitted.

2.3 *Evaluation based on the following standards* - The abrasive shall be listed on a generic basis as either medium or low dust in the Steel Structures Painting Manual, Volume 1 or certified by the California Air Resources Board (CARB) on a trade name basis.

2.3.1 The manufacturer must certify and submit documentation that the abrasive, before blasting, contains less than 0.5 ppm TCLP lead and less than 1 percent by weight free silica.

2.3.2 The gradation shall be such that the abrasive will produce a uniform profile of 1 mil to 2.8 mils, as measured with extra coarse Testex Replica Tape.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product.

Person in charge of Qualified Products List	-	Bryon Beck
Telephone	-	(517) 322-5722
Person in charge of Testing	-	Bryon Beck
Telephone	-	(517) 322-5722

3. Evaluation

3.1 The abrasive will be evaluated by MDOT for embedment into the steel, and the surface profile produced. If the product meets the requirements it will be included on a Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. The Michigan Department of Transportation reserves the right to verify submitted test information or reevaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6. Physical Requirements

6.1 It shall be listed on a generic basis as a medium or low dust abrasive in the Steel Structures Painting Manual, Volume 1, or it is certified by the California Air Resources Board on a trade name basis, and/or a field evaluation.

6.2 It shall have a gradation such that the abrasive will produce a uniform profile of 1 mil to 2.8 mils, as measured with the extra course Testex Replica Tape.

6.3 It shall contain less than 0.5 ppm leachable lead.

6.4 The material shall be listed on a generic basis in the Steel Structures Painting Manual, Volume 1, as an abrasive with <1 wt percent free silica or certified results of the analysis for free silica indicating <1 wt percent free silica. The free silica content shall be determined by the use of infrared spectroscopy or by other analytical procedures, such as wet chemical or x-ray diffraction analyses.

6.5 Technical information regarding the above requirements, Materials Safety Data Sheet and 25 kg sample shall be submitted to:

MDOT- Construction and Technology Division
Research Laboratory - Coating Systems
Secondary Governmental Complex
8885 Ricks Road
Lansing, MI 48909

6.6 The material will be evaluated by MDOT as to its dusting characteristics, embedment into the steel, and the surface profile it produced. If the product is judged to perform satisfactorily, it will be approved to be on the Qualified Products List.

6.7 Products may be deleted from the Qualified Products List by MDOT at any time they fail to meet any of the above requirements.

**Qualification Procedure
For
Plastic Drums**

1. Scope

1.1 This document covers the requirements that manufacturers will follow to have their plastic drums included on the Qualified Products List.

2. Submittal Procedure

2.1 *Sample Submittal* - Submit a sampling of (1) of each product for which approval is being requested to the MDOT address listed below:

Michigan Department of Transportation
Construction & Technology Division
Photometry Laboratory
Research Laboratory Section
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909

2.2 *Report of Tests* - The manufacturer shall certify that the product meets crash test requirements for National Cooperative Highway Research Program (NCHRP) Report 350, Category 1.

2.3 *Product Data Sheets* - Include product literature describing the use of plastic drum alternates for Type II Barricades, and any other pertinent information.

2.4 *Evaluation Based on the Following Standards* - The product will be evaluated for design compliance with the Michigan Manual of Uniform Traffic Control Devices (MMUTCD) and NCHRP-350 requirements for crash worthiness.

2.5 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product.

Person in charge of	
Qualified Products List	- Debra Rogers
Telephone	- (517) 322-5733
Person in charge of Testing	- Debra Rogers
Telephone	- (517) 322-5733

2.6 *Evaluation Scheduling* - The requested information and sample submittal must be received by MDOT no later than January 15 to be included in that year's evaluation. Addition of new products to the Qualified Products List will be made only once a year upon completion of evaluations for all materials submitted by the January 15 deadline. Subsequent modifications (for purposes other than the addition of new products) will be at the discretion of MDOT.

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or reevaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance as a result of product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive notification, including reasons for disqualification.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with the acceptable evidence the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6. Testing Procedure

6.1 Drum Design

6.1.1 Drums used for traffic warning or channelization shall be approximately 900 mm in height and minimum of 450 mm in diameter. The markings on drums shall be horizontal, circumferential, alternating orange and white reflectorized strips 100 mm to 200 mm wide, using a material that has a smooth, sealed outer surface which will display the same approximate size shape and color day and night.

6.1.2 There shall be at least two orange and two white stripes on each drum. All stripes shall be approximately the same width. The topmost stripe shall be orange and the nonreflectorized space above it shall be less than 100 mm. Any nonreflectorized space on the vertical sides of the drum shall be orange in color. If there are nonreflectorized spaces between the horizontal orange and white stripes, they shall be no more than 50 mm wide.

6.1.3 Drums should not be weighted with sand, water, or any material to the extent that they can cause harm to motorists, pedestrians, or workers if struck. When they are used in regions susceptible to freezing, they should have drain holes.

6.2 NCHRP-350 Certification

6.2.1 The manufacturer must submit documentation that shows the drum poses no risk to impacting vehicle occupants. Acceptable documentation would include: crash test experience with similar devices, years of demonstrably safe operational performance, or crash test data performed by an independent test facility.

**Qualification Procedure
for
Barrier Reflector Markers**

1. Scope

1.1 This document covers the procedure that manufacturers must follow to have their products included on the Michigan Department of Transportation's (MDOT) Qualified Products List for a qualification period of two years.

2. Submittal Procedure

2.1 *Sample Submittal* - Submit a sample of each model marker to the address listed below. Each sample shall consist of three of each color marker to be reviewed.

MDOT
Photometry Laboratory
Construction and Technology Division
8885 Ricks Road
Lansing, MI 48909

2.2 *Product Data Sheets* - Submit a copy of product literature describing the product's use and other pertinent information such as model number, photometric performance, and manufacturer's name and address.

2.3 *Evaluation based on the following standards* - Markers that meet the following criteria will be accepted:

1. The marker must be rectangular or trapezoid in shape.
2. The marker's reflective area must be composed of methyl acrylate and be a minimum of 7.5 square inches.
3. Photometric performance at .2 degrees observation angle and 0 degrees entrance angle must be greater than or equal to 100 candela/footcandle for white markers and greater than or equal to 70 candela/footcandle for yellow markers.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of Qualified Products List	-	Debra Rogers
Person in charge of Testing	-	Debra Rogers
Telephone	-	322-5733

3. Evaluation

3.1 The submitted information will be reviewed and the samples will be tested for conformance to the specified requirements. If the product meets the requirements, it will be included on the Qualified Products List. The submittal will be notified in writing concerning the results of the evaluation. Michigan Department of Transportation reserves the right to verify submitted test information or reevaluate a product anytime by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance as a result of product materials, manufacturing or plan dimension changes made by either the MDOT or the manufacturer.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for re-evaluation only after submittal of a written request along with acceptable evidence that the problems causing the disqualification have been corrected.

**Qualification Procedure
for
Solar Assist Lighted Arrow, Type C**

1. Scope

1.1 This document covers the requirements to be followed by producers in order to have their solar assist lighted arrow, type C, included on the Qualified Products List.

2. Submittal Procedure

2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the Solar-Assist Lighted Arrow Type C Evaluation Form and the required independent laboratory test data to the address listed below.

Photometry Laboratory
Research Laboratory Section
P.O. Box 30049
Lansing, MI 48909

2.2 *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as approval by other state agencies.

2.3 *Evaluation based on the following criteria* - The data submitted by the manufacturer regarding legibility, angularity, and power source reliability will be reviewed along with independent laboratory testing. The luminous intensity measurements of the lamp must be conducted by a laboratory with NIST (National Institute of Standards and Technology) traceability for luminous intensity. Products that meet the specified criteria will be placed on the QPL.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of Qualified Products List and testing-Debra Rogers - 517-322-5733

2.5 *Evaluation Scheduling* - Completed submittals must be received by MDOT no later the January 15 to be included in that year's evaluation. Addition of new products to the Qualified Products List will be made once a year upon completion of evaluations submitted by the January 15 deadline.

3. Evaluation

3.1 The submitted information will be reviewed for conformance to the specified requirements. If the product meets the requirements it will be included on the QPL. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own laboratory and/or field tests.

4. Disqualification

4.1 A product may be removed immediately from the QPL if any problems develop related to field performance. The manufacturer will receive notification including the reason for disqualification.

5. Requalification

5.1 A product which has been disqualified and removed from the QPL will be considered for re-evaluation only after submittal of a written request along with evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification.

**Qualified Product Procedure for
Type C Steady Burn Warning Lights, Light Emitting Diode**

1. Scope

1.1 This document covers the requirements to be followed by producers in order to have their Type C Steady Burn Warning Lights (LED) included on the Qualified Products List.

2. Submittal Procedure

2.1 Submit a sampling of lights to the MDOT address below. Each sampling will include three lights with bi-directional lens. Individual lamps are not acceptable. The sample must be an entire unit, consisting of the bi-directional lens, lamp, lampholder and housing. Batteries are not required.

Michigan Department of Transportation
Construction and Technology Division
Photometry Laboratory, Research Laboratory Section
8885 Ricks Road
P.O. Box 30049
Lansing, MI 48909

2.2 *Product Data Sheets* - Include product literature describing the product's use and other pertinent information.

2.3 *MDOT Contacts* - the following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of	
Qualified Products List	- Debra Rogers
Telephone	- (517) 322-5733
Person in charge of Testing	- Debra Rogers
Telephone	- (517) 322-5733

2.4 *Evaluation Scheduling* - Completed submittals must be received by MDOT no later than January 15 in order to be included in that year's evaluation. Addition of new products will be made once a year, upon completion of evaluations submitted by the January 15 deadline.

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance as a result of product materials or manufacturing changes made by either MDOT or the product manufacturer. The manufacturer will receive notification, including reasons for disqualification.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for re-evaluation only after submittal of a written request, along with acceptable evidence the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6. Testing Procedure

6.1 *Batteries:* Batteries to power the lights for testing will be checked prior to installation by using a 56 ohm resistor. All batteries must have the same voltage ± 0.1 volt. Two lights will be tested using heavy duty batteries and one will be tested using alkaline batteries.

6.2 *Light Setup:* Each light shall be photometrically tested for specific intensity within one hour from installation of batteries. Lights shall be kept in a dark room to hasten testing, and the room shall be at ambient temperature conditions.

6.3 *Photometric Procedure:* The lights will be tested for specific intensity in the 30 meter photometric range. The photocell shall be at .1 degree observation angle. Entrance angle measurements shall be taken in increments of 3 degrees beginning at center and ending at 9 degrees for each side of the vertical axis. Entrance angle measurements shall be taken in increments of 2.5 degrees beginning at center and ending at 5 degrees above and below the horizontal axis. The area measured shall encompass ± 9 degrees horizontal and ± 5 degrees vertical, resulting in 35 readings. The light shall be rotated 180 degrees and measurements repeated. The 70 measurements shall be calculated for specific intensity and averaged.

6.4 *Measurement Time Frame:* The lights shall be measured for specific intensity at one week intervals, or as often as deemed appropriate by MDOT personnel. The hours on time, beginning with 0 hours for the initial measurement, shall be documented each time photometric measurements are taken.

**Qualification Procedure
For
Epoxy Coating for Steel Reinforcement**

1. Scope

1.1 This document covers the physical requirements for epoxy coatings for steel reinforcement and the procedure to be followed by the producers to have their products included on MDOT's Qualified Product List.

2. Submittal Procedure

2.1 Submit the following criteria to the MDOT address listed below.

MDOT- Construction & Technology Division
Testing and Research Section - Paint Systems
Secondary Governmental Complex
8885 Ricks Road
Lansing, MI 48909

2.2 *Product Data Sheets* - Include product literature describing the product's use and other pertinent information such as design drawings, manufacturer's name and address, manufacturers' trade name, model number, etc.

2.3 *Evaluation based on the following standards* - The testing is conducted by an independent testing agency to ensure that the product meets ASTM D 3963M-93a and MDOT's requirements.

2.4 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product.

Person in charge of	
Qualified Products List	- Bryon Beck
Telephone	- (517) 322-5722
Person in charge of testing	- Bryon Beck
Telephone	- (517) 322-5722

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested (if required) for conformance to the specified requirements. If the product meets the requirements, it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or reevaluate a product anytime by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance results from product materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer.

5. Requalification

5.1 A product disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6. Testing Procedure

6.1 The testing procedure is conducted by an independent testing agency, who in return verifies that all of MDOT's requirements are met.

**Qualification Procedure
For
Bridge Coating Systems**

1. Scope

1.1 This document covers the requirements for bridge coating systems and the procedures for coating manufacturers to have their products included on MDOT's Qualified Products List.

2. Submittal Procedure

2.1 *Qualified Products Evaluation Form* - Submit a completed copy of the evaluation form (included in the Qualification Procedure packet) to the address listed below.

MDOT- Construction & Technology Division
Coatings Group
8885 Ricks Road
Lansing, MI 48909

2.2 *Product Data Sheets* - Only products with volatile organic content equal to or less than 450 g/L will be accepted. Do not submit systems that we have already tested more than once.

2.2.1 All products must be from the standard product line of the submitting company, e.g. special products just for Michigan are not allowed.

2.2.2 A history of good field performance and/or accelerated test results must be supplied for any product not previously tested by MDOT.

2.2.3 A completed product information form, product data sheet, and MSDS must be submitted for each product.

2.2.4 All products must be non detect by TCLP for lead and chromium with documentation from an independent laboratory.

2.2.5 The intermediate coat shall be white and the top coat shall be light gray (16440 Federal Color Code)

2.2.6 Submit two, four-liter kits for each product, even if it will be tested in more than one category. For example, if the components are to be mixed in a 1:1 ratio, send two, two-liter, containers of EACH component not a liter of each.

2.3 *MDOT Contacts* - The following MDOT personnel may be contacted if questions arise regarding the submittal and/or evaluation of this product.

Qualified Products List	-	Bryon Beck
Telephone	-	517/322-5722
Submittal Procedure	-	Bryon Beck
Telephone	-	517/322-5722

2.4 *Evaluation Scheduling* - Samples must be shipped by the deadline, in the letter of request, to be included in that year's program. No extensions will be granted. After the cut-off date, MDOT will send a letter to each submitting company listing their products that were accepted for testing.

3. Evaluation

3.1 The submitted information will be reviewed and samples will be tested for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List. The submitter will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or reevaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to products, materials, or manufacturing. The manufacturer will receive notification including reasons for disqualification.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requirements for qualification, as specified in this document, also apply for requalification of the product at the expiration of the qualification period.

6. Testing Procedure

6.1 Performance Evaluation based on the following standards:

6.1.1 *Salt Fog* - ASTM B-117, with scribed panels. Panels are evaluated every 1000 hours for a total of 5000 hours. They are evaluated on a 1 to 10 scale.

6.1.2 *UV Conn* - ASTM G-53, with scribed panels. Panels are evaluated every 1000 hours for a total of 5000 hours. They are evaluated on a 1 to 10 scale.

6.1.3 *Weather Cycle* - Panels are evaluated every two cycles for a total of 10 cycles. They are evaluated on a 1 to 10 scale. One cycle consists of:

6.1.3.1 5 freeze thaw cycles

6.1.3.2 200 hours in the UV Conn (G-53)

6.1.3.3 50 hours in the salt fog (B-117)

6.1.4 *100% Humidity* - Panels are scribed and placed in a concrete curing room, temperature 25 °C, humidity 100%. Panels are evaluated every 1200 hours for a total of 6000 hours. They are evaluated on a 1 to 10 scale.

6.1.5 *Envirotest* - The envirotest has no ASTM standard procedure. The chamber has a paddle wheel configuration that makes one revolution every 4 hours. The top of the chamber is heated to 50 °C and contains an ultraviolet light source. The bottom contains enough 3% NaCl solution to cover the panels for 80 minutes each rotation. Panels are scribed and evaluated every 1000 hours for a total of 5000 hours. They are evaluated on a 1 to 10 scale.

6.1.6 *Outdoor* - Panels are scribed and mounted on a bridge in a semi-rural area. They are evaluated on a pass/fail basis.

6.2 *Application Evaluation based on the following standards -*

6.2.1 *Mixing*: During mixing of the products, they are evaluated on a 1 to 10 scale.

6.2.2 *Sagging*: Products are evaluated by using a modification of the Hegman grind gage. Products are drawn down, let set for 10 seconds and the gage turned on its side for 30 seconds. The sag is recorded as the point where the product drips out of the groove. It is evaluated on a 1 to 10 scale.

6.2.3 *Spray ability or brush ability*: During the spraying or brushing of the products, they are evaluated on a 1 to 10 scale.

6.2.4 *Settling*: During the application of the products, evaluated on a 1 to 10 scale.

**Qualification Procedure
For
Retroreflective Sheeting for Permanent Signing**

1. Scope

1.1. This document covers requirements for retroreflective sheeting used in permanent signing and the procedure manufacturers must follow to have their products included on the Michigan Department of Transportation's (MDOT) Qualified Products List.

2. Submittal Procedure

2.1 Retroreflective sheeting samples are submitted directly to the National Testing Program Evaluation Program (NTPEP) for evaluation in their two year testing program.

2.2 Evaluation based on the following standards - MDOT reviews the two (2) year data provided by the NTPEP . If NTPEP testing meets MDOT requirements, a fabrication test and field test are scheduled in Michigan. Michigan Department of Transportation approval is based on successful fabrication test and acceptable field performance in Michigan. National Testing Program Evaluation Program testing, MDOT fabrication of signs and field testing are requirements for all new suppliers or for suppliers attempting to requalify a product that was removed from the Qualified Products List.

2.4 MDOT Contacts - The following MDOT personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of NTPEP evaluation	-	Steven Lenker
Telephone	-	(202) 624-3695
Person in charge of MDOT evaluation	-	Debra Rogers
Telephone	-	(517) 322-5733

2.5 Evaluation Scheduling - MDOT reviews the permanent sheeting Qualified Products List on an annual basis. Time requirements for field testing will be at the discretion of the MDOT, but will be a minimum of one year.

3. Evaluation

3.1 The NTPEP data, MDOT fabrication results, and MDOT field performance will be reviewed for conformance to the specified requirements. If the product meets the requirements it will be included on the Qualified Products List for one (1) year. At the end of the one (1) year time period, continued evaluation and approval of the product will be based on continued successful fabrication and field performance. Michigan Department of Transportation reserves the right to verify submitted test information or to reevaluate a product anytime by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problem develop related to fabrication or performance of the product. A product may also be removed due to specification or material changes made by either MDOT or the manufacturer.

5. Reevaluation

5.1 A product that has been disqualified and removed from the Qualified Products List will be considered for reevaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected. The requalification process for a disqualified product is the same as the qualification procedure for a new supplier as specified in this document.

**Qualification Procedure
for
Flexible Plastic Delineator Posts, Ground Mount**

1. Scope

1.1 This document covers the requirements for flexible delineator posts and the procedure to be followed by manufacturers in order to have their products included on MDOT's Qualified Product List.

2. Submittal Procedure

2.1 *Sampling* - Flexible delineator post samples are submitted directly to the National Testing Product Evaluation Program (NTPEP) for evaluation in their testing program. Posts must undergo summer and winter impact testing.

2.2 *Report of tests* - The manufacturer must submit the following information when requesting product approval.

2.2.1 A letter indicating NTPEP testing has been completed within the past three years and include the dates of test. A copy of NTPEP test results does not have to be submitted unless specifically requested by the MDOT.

2.2.2 Manufacturer name and address, product literature, model number, installation instructions, and any other pertinent information.

2.3 *Evaluation based on the following standards* - The MDOT initially approves flexible delineator posts based on NTPEP test results. Once the product is evaluated and approved, it is placed on the Qualified Products List for at least two years. Continued use of the product is dependent upon satisfactory laboratory and/or field performance.

2.4 *MDOT Contacts* - The following personnel may be contacted if questions arise regarding submittal and/or evaluation of this product:

Person in charge of NTPEP Evaluation	-	Mujeeb Basha
Telephone	-	(202) 624-3695
Person in charge of MDOT Evaluation	-	Debra Rogers
Telephone	-	(517) 322-5733

2.5 *Evaluation Scheduling* - New product submittals will be evaluated by MDOT throughout the year.

3. Evaluation

3.1 The MDOT reviews NTPEP data for conformance to the specified requirements. The survival rate after winter and summer impact testing is the primary factor in selecting products. If the product meets the requirements it will be included on the Qualified Products List. The manufacturer will be notified in writing concerning the results of the evaluation. MDOT reserves the right to verify submitted test information or re-evaluate a product at any time by conducting its own tests.

4. Disqualification

4.1 A product may be immediately removed from the Qualified Products List should any problems develop related to installation or performance as a result of products materials, manufacturing, or plan dimension changes made by either MDOT or the product manufacturer. The manufacturer will receive notification including reasons for disqualification.

5. Requalification

5.1 A product which has been disqualified and removed from the Qualified Products List will be considered for re-evaluation only after submittal of a written request along with the acceptable evidence that the problems causing the disqualification have been corrected.